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CIVIL ENGINEERING.

*On Submarine Telegraph Cables.** By J. Bodie, R. N., Master of H. M. S. "*Agamemnon.*"

I must preface the following remarks by observing, that all the statements are deduced from personal observation, and the calculations for specific gravities obtained from the pamphlet on "Deep Soundings in the Mediterranean," by Captain Spratt, as well as those made by American officers, which are published in Lieut. Maury's excellent work on the "Sea."

Where theory is indulged in, it is to show what is probably the effect of the elements of air and water operating on each other when in great depths, causing the disintegration of foreign bodies, as earths, &c., and their disrupture into small particles, forming mud or sand.

Having been appointed to H. M. S. *Agamemnon*, when that ship was first prepared for the reception of the Atlantic telegraph cable, I have had an opportunity of minutely observing all the arrangements and appliances which it was hoped would ensure the safe deposition of the wire at the bottom of the ocean; and, with every one else, I very much regret the failure of the attempt.

Observing the rapidity with which the cable issued from the *Agamemnon* during some of the experiments, and remarking also the small angle it in general made with the horizon while being paid out from the *Niagara*, I was induced to ascertain its specific gravity, which proved 2952,

*From the Lond. Mech. Mag., Oct., 1857.

water (salt) being assumed to be 1026; and also seeing that it generally exhibited an angle of from 11° to 22° with the plane of the sea under nearly any rate of speed of the ship, it was manifest that the cable was unnecessarily heavy; for as soon as it entered the denser medium of salt water (from air), it immediately quitted the slightly depressed line, and formed a more abrupt one towards the bottom, using the sea as an inclined plane. When the ship arrived over deep water (2000 fathoms), it commenced rushing downwards with great velocity, gradually acquiring so much speed and tension as to bring the strain upon it up to three tons!—a strain far greater than could possibly be necessary, as, from the immense size of both the conveying vessels, any undue strain would break even their chain-cables like a cobweb.

It has hitherto been the custom to make all submarine cables with an outer coating of wire rope; and, where the water is shoal, or they are laid in places where the anchor of vessels may grapple them, it is proper that such a coating should be over the gutta-percha, to give the weight necessary to resist the action of the waves, as well as strength to withstand the strain of a ship's cable; but in deep water I consider that this ponderosity may be considerably reduced, as any surface agitation from gales of wind can only disturb the waters to a certain depth; therefore any extra weight in a submarine cable beneath that depth is quite useless; and if it were required to recover the cable, that weight would bring such an excessive strain upon the upper part, as it passed over the sheaves when coming in board, as would probably cause it to break.

Now, if a submarine cable were covered with hemp-rope instead of wire, the strength would not be so great; but still, in proportion, it would bear much more lifting power, and be more easily recovered from the deep sea.

A five-eighth telegraphic wire-covered cable will bear a strain of 4 tons, and require to lift a positive weight of 25 cwt. out of water two miles deep, besides the nip that such a depth has upon the cable: but a five-eighth telegraphic hemp-covered cable will bear a strain of $1\frac{1}{4}$ tons, and require only to lift a weight of 4 cwt. out of water of the same depth.

It is true that the same amount of nip is on both, but it is well-known how much easier it is to drag a comparatively light substance from great depths than a heavy one, as is exemplified by the constant recovery of the twine and cordage used in deep-sea soundings, to many of which lines considerable weights are attached; but there has been no instance yet where wire-covered cables have been recovered from any great depth; in fact, every attempt to do so has carried them away.

Again, the log-line of a man-of-war is generally used from 720 to 1000 times before it is worn out, and each time it is probably hauled in over two or three frictional points; how much more likely then is it that a submarine wire, protected by twelve log-lines as an outer covering, would deposit itself safely on the bottom when only once paid out of a ship, and part of it be recovered to repair any damage of its continuity or insulation.

From the foregoing observations it appears that to lay a cable successfully in the deep sea, there should be three several sorts of cable employed,—viz: that which will have to be subjected to the influence of waves, and the chance of abrasion from anchors, stones, or sand,—a second part which may be affected by a slight agitation of the bottom;—and a third part to be immersed in the deep sea, which should not (of whatever material it is composed,) have a greater specific gravity than 1528, (sea sand,) though a gravity of 1234 (common tarred rope) would be quite enough—the latter gravity sinking at the rate of 100 fathoms in ten minutes, (or 2000 fathoms in three hours and twenty minutes,) a rate rapid enough for any purpose of immersion, and ensuring a straight and uniform issue of cable from the ship.

The expense of a cable coated with hempen rope would be about 30 per cent. less than that of one coated with iron; a much greater length could be carried by each vessel; and the risk of kinking would be *nil*, as the service being on the outside would keep the lay in the strands, and give sufficient stiffness to prevent any kinks possibly getting on the cylinder when about to issue into the sea; and by allowing great freedom in its paying overboard, slack enough would remain to compensate for any under currents which may exist in the ocean.

These currents have often been discussed, and what has been advanced relative to their existence appears vague. That surface currents are in constant operation there cannot be a doubt; but that any under current can run with a rapidity that would affect a cable sinking at the rate of ten minutes per 100 fathoms, I doubt very much.

It is manifest that a surface current is constantly setting from the Polar Sea towards the Gulf Stream, as witnessed by the drift of ice, and the wrecks of abandoned vessels that are often seen. To keep up the supply of this surface current, an under current, or rather the whole body of the Atlantic Ocean, must in time reach the Polar Sea; but such an immense mass of water, reaching miles deep by thousands of miles broad, must approach that dreary region very slowly indeed, even if its motion could be called perceptible; thus making not the least obstacle to the sinking of any substance heavier than water; and as the active current does not probably extend more than 50 fathoms, if even so much, below the surface, very little time would elapse whilst the submerged cable was in its influence. The day previous to the cable parting on board the *Niagara*, a surface current was experienced, setting the cable apparently on the quarter of the ship, when, in fact, it was the ship setting away from the cable. This was erroneously imagined to be an under current, and described as such.

In speaking of the currents, and their influence on the telegraphic plateau, it appears the bergs have for ages drifted periodically from the northward towards the Gulf Stream, down the Atlantic in a S. S. E. true direction, gradually melting as they advance to the south, under the influence of a more genial climate and a warmer sea, and depositing their debris of earths and stones in the ocean, wherever these materials may become separated from the mass; thus in the course of time raising the

bottom to the depth now obtained, and making an even surface, on which, it is hoped, the telegraphic cable will some day lie.

That the surface of this plateau is generally composed of ooze or mud, may be conjectured from the fact that all light substances brought by the bergs into very deep water and there separated, as they sink, are subjected to an enormous pressure, which causes the water to permeate and disrupt them into minute particles, forming mud or sand. Where denser substances are separated, they, being heavier, sink lower, and form a substratum. Thus in all deep seas we may conclude that the bottom will be of oose, ready to form a bed for the reception of a telegraphic cable; and if the outer coating of such a cable be formed of hempen rope, it will remain a good protector of the gutta-percha for years, and need not, when once placed, be disturbed for a very long period.

From experiments I have made, as well as calculations of the decrease of specific gravity by the combined descent of a lead and line, it may be inferred that bodies heavier than water descend at an uniform rate through all depths of the ocean. The following table was formed from the soundings obtained in the Mediterranean last year, and is calculated at seine twine, (the sounding line,) being 240 fathoms to the pound; and as every fathom the sounding lead descends alters the specific gravity of the combined materials, a very fair estimate of the rate of descent for each gravity may be formed.

From the table on page 149 it will appear, that the rate of descent is as the amount of specific gravity; and as in the table the quantity of friction is not taken into account, we may safely infer that the gravities, if left to themselves, would descend even more quickly than there observed, particularly the lighter ones. From this table a more simple one may be readily formed as follows, which will show at a glance at what rate any cable of known gravity would sink.

Specific Gravities.	Minutes of Time required to descend.		REMARKS.
	100 fms.	2000 fms.	
	m.	m. s.	
5·5	2·2	44 0	
5·5	2·4	48 0	
4.	2·9	58 0	
4·	3·4	68 0	Shore end At. Cable, 4218.
3·5	3·8	76 0	
3·	4·4	88 0	Ocean part Atlantic Cable 2952.
2·5	5·0	100 0	
2·	6·5	130 0	
1·5	9·1	182 0	Proposed hemp-covd. cable, 1319.
1234	10·0	200 0	Common Rope.

TABLE *showing at what rate substances of various Specific Gravities descend in the Ocean. Deduced from Deep-Sea Soundings.* By JAMES BODIE.

Specific Gravities.	Number of Fathoms below the surface.	Time Specific Gravity takes to sink 100 fathoms.	Time occupied in descending the fathoms in 2d column.	REMARKS.
		m. s.	m. s.	
5885	277	2 23	6 36	
5636	277	2 36	7 12	Mediterranean soundings, seine twine, 240 fathoms to the lb.
5533	277	2 6	5 49	
4877	277	2 17	6 14	
4848	517	3 23	17 29	
4609	277	2 48	7 45	
4594	277	3 5	8 32	
4192	517	3 35	18 31	Spec. grav. of shore end Atlantic Cable, 4218.
3808	795	3 24	27 2	
3762	795	3 46	29 56	
3505	795	3 40	29 9	
3494	1012	3 35	36 13	
3469	795	4 2	34 35	
3313	795	4 9	33 00	
3134	1310	3 58	51 57	Spec. grav. of Limestone, 3136.
3095	795	4 40	37 5	
3064	1012	4 17	43 21	
3032	1012	4 13	42 40	
2920	1012	5 9	52 6	Spec. grav. of Atlantic Ocean Cab., 2952, diam. $\frac{3}{8}$-inch.
2912	1012	4 34	46 12	
2900	1530	3 43	56 52	Spec. grav. of Parian Marble, 2838.
2818	1012	4 5	41 59	
2817	1530	5 24	81 36	
2706	1807	4 22	78 54	
2523	1965	6 7	120 0	
2554	1310	5 10	67 20	
2287	1965	5 44	112 38	Spec. grav. of Ocean Cable covered with 3-yarn spun yarn, 2280, diameter $\frac{7}{8}$-inch.
2221	1965	6 17	123 20	
2286	1500	6 42	70 40	
2447	2000	6 2	120 40	
2145	2000	6 17	125 40	Spec. grav. of Grindstone, 2143.
2056	2000	6 58	139 20	
2397	2000	3 40	73 20	Amer. sdngs, wx. twine, 90 fms. to lb.
2201	2500	4 1	100 25	" " " "
2073	3000	4 30	135 0	" " " "
1500		8 48		Spec. grav. of sea sand, 1528.
1319		9 36		" " of hemp-covd. cable silk.
1234		10 00		" " of com. tard. rope. [1300.

By this table it will be seen, that the cable whose specific gravity is 2952, will take one hour and thirty minutes to descend 2000 fathoms; and the cable whose specific gravity is 1500, will take three hours and two minutes to descend to the same depth; thus making one hour and thirty minutes difference in the descent, and nearly 50 per cent. difference in the gravities—ensuring in the one case an easy and gradual rate of sinking, whilst in the other case, its great weight causes it to make a rush that there is hardly any possibility of controlling. Again, the

hemp-covered cable could be paid out simply like any other rope, the machinery being merely a four-feet diameter cylinder, controlled by common crane brakes, and divided by brass rods to keep the turns from riding; ensuring, without any other contrivance, simple and complete control, with quite enough power to break any strength of cable that need be immersed in the sea.

From the foregoing remarks it would appear that in all future operations of laying deep-sea telegraphic cables, they should be, with respect to specific gravity, in an inverse ratio to the depth of the sea on the intended route; that is, the shoaler the water the heavier the cable, and *vice versâ*, the lightest gravity of the cable being about 20 per cent. more than the material composing the bottom, which is brought up by the sounding lead from the greatest depth.

The shore ends of such a cable should extend into forty-five or fifty fathoms water; then cable of 2952 to about 250 fathoms, that being the greatest depth which I think the surface agitation caused by gales could affect the bed of the sea. From that depth until a corresponding depth is reached on the opposite side, the lightest cable should be used, and the speed of the paying-out ship be as great as its issue from the hold would allow. By these means, and careful coiling, no possible foul could occur; and the friction of the inboard part of the cable, combined with its weight coming up the hatchway, would, from its easy and light deposit in the sea, hardly require the least strain on the brakes of the cylinder; but if in paying overboard the heavier portion, or shore end, one cylinder would be insufficient to hold the cable, another might be applied before it.

These cylinders should be placed close aft, so that time should be given to clear any impediment to their revolutions that might be brought up on the cable from below; and the attendant at the brake should face forward, to see that the cable came up clear from the tier, a bell-handle being within his reach to signal, "reverse the ship's engine instantly."

If in the next attempt the present Atlantic telegraphic cable were served with three-yarn spun yarn, it would decrease its specific gravity to 2280, and increase its chances of success fifty per cent., although its diameter would be increased from five-eighths to seven-eighths of an inch.

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*The Emperor's Train.**

The novelty in the imperial train consists in the manner in which the carriages are united together by little suspension bridges, highly carved and ornamented. The first carriage is occupied by the servants, the second by the *personnel* of his Majesty's suit; then comes the dining hall, entirely lined with carved oak and gilt leather—a raised dais marks the place to be occupied by their Majesties. At length comes the "terrace wagon," an entire novelty, both in execution and intention. It serves as summer house or belvedere, for the better view of the country through which the train is passing, and is surrounded by a gilt balustrade, round

* From the London Mining Journal, No. 1154.

which are set cushioned divans, and baskets filled with odoriferous flowers. The drawing-room is in the style Louis Quinze, sea-green, carpeted with a flowery-patterned Aubusson. The bed-chamber is divided into four compartments, each containing a couch, for the repose of the Emperor and Empress, the Prince Imperial, and his *gouvernante*. The two former are fitted in blue velvet and gold, the two latter in violet and gold.—*Court Journal.*

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*On the Improvement of Canals and Inland Navigation. Suggestions for the permanent Improvement of Canals and Inland Navigation, with the view of re-establishing them as the most natural and efficient means of transit for the heavy goods of the country.**

[Condensed from the Second selected Essay prepared in Competition for the Premium offered by the Canal Association, Leeds, in 1856.]

Introduotory Chapter.

Everybody knows that prior to the introduction of railways, nearly all the goods traffic of the country was conducted by means of canals and navigable rivers, which traverse the length and breadth of the country, calling at every town of importance, and forming a net-work of water communication little less elaborate than the iron ways of modern railroads. Yet it is evident to all, that so thoroughly have railways absorbed public attention of late years, that the peculiar advantages of water-ways have been lost sight of, or sacrificed to expedition and cheap rates. The latent worth of that old established mode of conveyance, and its facility of adaptation to the wants of the present time, should recommend every suggestion for their improvement to the serious consideration of the commercial public.

The object of the present remarks is simply to point out the most effectual mode of dealing with them, so that their use may become not only popular, but singularly advantageous to the public, and remunerative to the proprietors. Ample room would still be left for their natural rivals—the railways—to whom their antagonism would be found less detrimental than has hitherto been supposed. Indeed, it might be proved that some of our railways are rather losers than gainers by their goods traffic, after deducting all expenses, including wear and tear. Certainly the heavy goods by their damage to the permanent way, and other evils, entail more trouble and expense than profit. At all events, a more favorable time could not be chosen than the present, for urging the revival of canals. The goods traffic has so immensely augmented during the last few years, that many railways have more than they can manage, and a double line of rails has been spoken of as the only efficient means of accomplishing the herculean task. (See the Statistics in the Appendix, p. 159.)

It is of little consequence to inquire whether or not canal companies have chiefly themselves to blame for being so completely shut out of the field; it is sufficient for our present purpose, that however apathetical they

* From the Lond. Civ. Eng. and Arch. Jour., Jan., 1858.

may have been in the past, there are still great opportunities open to them in the future, whereby they may regain much that they have lost.

Nevertheless, the writer (an old carrier of some forty years' standing) may be allowed to mention that in the year 1838 he opened a railway bill in Parliament, and obtained the introduction of six clauses for the protection of carriers, which had the effect of postponing the period of railways becoming carriers, for two years. Had it not been from disunion among canal companies and carriers themselves, frustrating all attempts at co-operation, there is little doubt but railways would have been compelled to carry on toll, the same as canals, and in so far the carriers would have been protected. Further than this, however, and in the same year (1838), and also at his own expense, the writer endeavored to secure the introduction of steam as a propelling power on canals. And in order to solve the problem of its practicability, he employed Mr. Braithwaite, the engineer, to apply an engine and screw propeller to a common canal boat; the late Mr. C. H. Wild superintended the experiment, and a steamboat, carrying cargo, proceeded from London to Manchester, along the various canals. And although detained between London and Braunston for one day and a-half, from shortness of water, it arrived in Manchester in the usual time occupied by towing-horses, and returned *via* the Oxford canal to Oxford, and thence down the river Thames to London, performing ten miles per hour on the river.

The result of the experiment proved, that the time lost in passing the locks (about 200 in number), the small depth of water, the shelving shores, and the narrow width of canals, would prevent competition with railways; but that where there was sufficient depth of water, seven miles per hour could be maintained, it also demonstrated that if canals were only so far improved in their construction as to allow of the average speed of seven miles per hour being obtained, it would bring London and Manchester within thirty-six hours of each other, and thus enable canals effectually to compete with railways for the heavy goods traffic even as to time. Their superiority in every other respect is undeniable.

Although these conclusions, arrived at by actual experiment, were circulated at the time, and suggestions thrown out for the improvement of water-ways, no serious attempt has since been made to secure their general adoption.

Under these circumstances it was no small matter of rejoicing to the writer to observe an advertisement in the papers, put forth by the Canal Association, from the Aire and Calder Navigation Office, Leeds, offering a premium for the best essay on the improvement of canals, which was duly awarded to a civil engineer resident in France, who scientifically demonstrated the practicability of many of the following suggestions, abridged from the essay prepared by the writer in competition for the said premium.

Chapter I.

The introduction of *steam power* on canals is the first great requirement; but it has already been shown to be comparatively useless, unless the canals themselves are prepared for the reception of this new principle of propulsion; and also, unless canal companies will co-operate

in seeking to secure for themselves a return of their heavy goods traffic. It is proposed that such of the canal companies should undertake or consent to the improvement of the construction of their several canals as will together form a series of continuous routes, connecting the principal towns, manufacturing and mining districts, by means of existing canals and inland navigations; upon which lines of water-way steam propulsion shall take the place of horse haulage, thus rendering unnecessary all towing-paths along the several routes. For example, there should be a line of improved canals, say, between London and Manchester; Manchester and Hull; Hull and Bristol; Bristol and Liverpool; Liverpool and London; London and Bristol, Portsmouth, Hull, &c.

With reference to the particular improvements required upon those canals included in the above routes, the following are the chief. The width of every canal must be not less than from 42 to 45 feet of clear water-way; the depth not less than from 7 to 8 feet in the centre, and 4 to 5 feet at the sides, with plomb shores. The whole of the levels to be carefully examined and compared by competent engineers, with the view of considerably reducing the number of locks now existing, substituting tunnels and cuttings wherever practicable. The locks to have a fall of not less than 12 or 15 feet, but 2 or 3 feet deeper still would be all the more advantageous where it is attainable. They should be from 80 to 90 feet long or more, but no less; and at least 15 feet in width. The locks in all cases to be fixed in pairs, that two boats may pass at the same time, one up and the other down, by which arrangement half the water may be saved, and labor and time gained in like proportion; or better still, each lock may be 30 feet in width, to allow of the simultaneous passage of two boats up and two down. Every opportunity of shortening the length of canals to be embraced, either by new cuttings or diversions through intervening and adjoining lands, for which it is presumed that the consent of the proprietors would in most cases be readily obtained.

Warehouses should be erected at the junctions of branch lines, to store goods intended for transit by the main routes. No boats to be allowed on the main routes but those specially constructed for them on the model hereafter described. The navigations and canals with their branches not included in the main routes, may still continue to pursue their old system, acting as feeders to the main routes. Any canal may be brought into direct communication with the main routes by adopting the required improvements, and applying steam power and boats of the prescribed form.

This arrangement will not only allow each individual canal that agrees to combine with others in the proposed improvements to perform the works required to be done by each canal on the routes themselves, but will also permit those railways that have purchased canals to unite their interest with other canals in the improvement of any given route in which the railways may be interested, thus becoming auxiliaries instead of antagonists.

It would very materially assist in setting out the various routes that may be determined upon for the improvement of canal and inland navi-

gation, if a map of England arranged as follows were provided: The towns marked upon it, without railways or roads, having the boundaries of counties shown by yellow lines. The whole of the canals set out to scale marked red, showing commencement, junctions, and termination, length of each canal, depth of water, number of locks, their levels in feet above or below the larger rivers, as the Thames, Mersey, Humber, and Severn. The whole of the navigable rivers set out to scale, marked green, showing their source, how far navigable, their junctions with other rivers or canals, and their termination, number of locks, depth of water, length of the navigation, their level in feet above or below the larger rivers above named. Then set out the whole of the small rivers not navigable, marked black, showing their source, termination, junction with other rivers, &c., length in miles, and their levels above or below the four larger rivers above stated. The whole set out to scale in miles and quarter miles.

The kind of craft well adapted for use on the improved canals should be of about 14 feet beam, from 75 to 77 feet in length, 5 feet in depth, flat bottomed, having three kelsals, iron knees, sheathed and false floored; the bottom streak to be set bilge form; the fore-end to be sharp like a common canal-boat, bilged towards and at the shoulders. The men's cabin to be placed at the fore-end; the stern-end to be arranged for the engine-room, lined with plate iron; the hold to be 54 feet from stem to stern. The engine to be from 10 to 12-horse power, compactly made to take little space, with a high-pressure tubular boiler, and screw propeller of from 4 to 5 feet diameter, which should be protected by sheet iron on each side of the stern; the rudder placed at the extreme end after the propeller. The stern-end of the boat should be somewhat contracted to prevent holding back water.

A boat and engine of the above description will make at the least from 7 to 8 miles per hour on an improved canal, and tow another with but little diminished speed, or will tow three others with a diminished speed of from 1½ to 2 miles per hour. The above boat will require in working, 2 men as steerers, 1 engineer, and 1 stoker. The Aire and Calder Navigation Company use none but iron boats on their canal.

Boats for the conveyance of coal, stone, slate, tiles, bricks, road material, manure, timber, iron in pigs, pipes, scrap, or any other mineral or article that will bear exposure and not be damageable, to be made of iron, open, with side cloths only, of the size and external form of the steamboat. One man only required as a steerer to each of these boats.

A number of these boats should always be kept ready laden, that the steamer may take one or more in tow (up to three), according as time allows.

Memorandum.—Since writing these suggestions the author has heard that the proprietors of the river Lea have improved their navigation from the river Thames, by removing their old locks, and substituting double locks; reducing their number, as the writer has herein suggested; giving from 7 to 8 feet depth of water to the navigation; making the new locks 90 feet long and 15 feet wide.

It is also satisfactory to notice efforts already made on other navigations and canals; the river Severn is being improved above Gloucester; the Ashby-de-la-Zouch canal is about applying steam; and also, it is said, the Oxford canal: in fact, there appears a general movement and effort among the proprietors and the public in favor of canals. The frequent collisions with goods and coal trains on railways, with the serious injuries and loss of lives, together with the large destruction of property, speak trumpet-tongued in favor of improving the system of the inland navigation of the country.

Chapter II.

The diminished expense of wear and tear and friction, upon canals, in comparison with railways, is of itself a large profit in favor of canals, their improved construction reducing the expense of repairing locks and towing-paths, the cost for the maintenance of the water-way being very small in comparison with the cost of the permanent way of railways; and by having a less number of locks, the wear of boats and engines will be proportionably decreased.

We will now compare the cost of working canals in their present state, with the cost of working them by steam power in their improved state.

The present system of towing boats by horses, carrying a cargo of 20 tons for 200 miles, taking from 4 to 5 days to perform the distance, costs, for horses about 5*d.* per mile, which is £4 3*s.* 4*d.* for the 200 miles; for men's wages, £3 10*s.* for the same distance; amounting together to £7 13*s.* 4*d.*, being a cost of 7*s.* 8*d.* per ton.

On improved canals, by steam power, with improved steamboat and screw propeller, the steamboat carrying 50 tons of cargo, and towing another boat also carrying 50 tons of cargo (together 100 tons), performing 200 miles in 36 hours; at a cost for coal of 10*s.* per ton for the engine, consuming 4 tons of coal for the distance of 200 miles, will cost £2; 7 men's wages for 3 days at 5*s.* per day each, will be £5 5*s.*; oil, &c. for the engine about 5*s.*; making together the total cost of £7 10*s.* for the distance of 200 miles, being 1*s.* 6*d.* per ton for the distance; showing 6*s.* 2*d.* per ton in favor of steam. The seven men would navigate four boats of 50 tons cargo each, or 200 tons total. I have taken the wages at a full rate, to allow of extra wages being paid to the engineer.

The railways charge for packs and such like goods about 35*s.* per ton, and for some goods about 20*s.* per ton; for coals about $\frac{1}{2}$*d.* per ton per mile, being 8*s.* 4*d.* per ton for 200 miles. We will now show what steam power may be expected to do upon improved canals, by a few calculations taken at various low rates, &c.

Suppose the steamer conveys a cargo of 50 tons at the rate of 20*s.* per ton, 200 miles will realize £50 for freight; and also tows another boat carrying 50 tons of coal at about $\frac{1}{4}$*d.* per ton per mile, or 4*s.* 2*d.* per ton for the distance of 200 miles, will realize for freight £10 8*s.* 4*d.*; taking the two cargoes together gives a total of £60 8*s.* 4*d.* We deduct the expense of the steamer's cargo:—For collecting and carting at both ends 5*s.* per ton, or £12 10*s.* for the 50 tons; the transit expenses for

wages, coal, &c. as before shown, £7 10*s.*; forming a total cost of £20 to be deducted from the total receipts stated above of £60 8*s.* 4*d.* as profit on the trip. Coals are generally put on board and delivered without cost to the carrier.

Again, we will take 50 tons of cargo conveyed by the steamer, and she tows another boat having also 50 tons of cargo, being together 100 tons, at 15*s.* per ton, conveyed 200 miles, will realize for freight £75: we deduct the expenses of collecting and carting at both ends at 5*s.* per ton, or £25 for the 100 tons, and £7 10*s.* for transit expenses, being a total cost of £32 10*s.* to be deducted from the receipts of £75, as above, leaves £42 10*s.* as profit on the trip.

Again, we will take 50 tons cargo conveyed by the steamer, which tows another boat having also 50 tons of cargo, being together 100 tons, at 10*s.* per ton conveyed 200 miles, will realize for freight £50. We deduct the expenses of collecting and carting at both ends at 5*s.* per ton, or £25 for the 100 tons, and £7 10*s.* for the transit expenses; forming a total of £32 10*s.* to be deducted from the receipts of £50 above, leaves £17 10*s.* as profit on the trip.

Again, we will take 50 tons cargo conveyed by the steamer, at 30*s.* per ton, realizing £75 for freight, and tows another boat with 50 tons cargo of coal at ½*d.* per ton per mile, or 8*s.* 4*d.* per ton for the distance of 200 miles, realizing £20 16*s.* 8*d.* for freight; making the total receipts for the two cargoes £95 16*s.* 8*d.* We deduct the expenses of collecting and carting the steamer's cargo of 50 tons at 5*s.* per ton, or £12 10*s.*, and £7 10*s.* for the transit expenses; being a total cost of £20 to be deducted from the receipts of £95 16*s.* 8*d.* as above, leaves £75 16*s.* 8*d.* as profit on the trip.

Again, we will take the steamer as carrying herself 50 tons of coal, and tows three other boats carrying cargoes of 50 tons of coal each, making together 200 tons, 200 miles at ½*d.* per ton per mile, or 8*s.* 4*d.* per ton for the whole distance, realizing as freight £83 6*s.* 8*d.* We deduct the expense of transit (only £7 10*s.*) from the receipts above, of £83 6*s.* 8*d.*, leaves £75 16*s.* 8*d.* as profit on the trip.

The above will be sufficient to show some results of the application of steam on improved canals; the calculations may be carried out to any extent.

If a continuous supply of coal, stone, &c. could be depended on, and which by arrangement might probably be obtained, the steamer need never leave without a 50-ton boat in tow, besides its own cargo, and thus will always ensure a good paying trip.

Thus it will be seen, as shown above, that improved canals, with steam power, will be able to convey, at a profit, at such rates as railways cannot do without loss.

It will be important to estimate the value of stock or material used on railways for conveying 200 tons of coal:—The cost or value of the locomotive engine is from £1200 to £1400; its annual repairs from £200 to £400; 30 trucks, carrying 7 tons each, value about £50 each, or £1500 total; their annual repairs about £3 each, or £90 (if trucks are made to carry increased weight they would cost more); hence the

cost of stock or material used by railways is from £2700 to £2900, besides annual wear and tear, and the cost from damages arising from collisions, &c., from the crowded state of the railway.

The estimated cost of stock or material employed on improved canals, using steam power:—The cost of steamboat carrying 50 tons, about £300; the cost of the engine, about £400; together, £700: the cost of 3 open boats, carrying 50 tons each, towed by the steamer, £180 each, or £540 together: the first annual cost for repairs will be but small, and after they begin to require repairs, £200 per year will cover the amount of engine and boats, unless from accident: hence the cost of stock and material used on improved canals, is about £1240 for 1 steamer and 3 boats, without annual wear and tear.

To enter more fully into the coal and mineral traffic, I have given, as above, the amount of floating stock used in one trip of 200 miles and return in 5 days, as £1240, calculating 1 engine and 4 boats, which is as short a time as railways take to load, convey, discharge, and return their empty trucks for a fresh trip. If the £1240 be multiplied by 5, it gives £6200 as the cost of the floating stock required to accomplish 1 trip per day continuously, or 313 trips in the year, employing 5 engines and 20 boats; every additional trip per day, continuously, requires £6200 value of floating stock to carry it out.

The freight paid to colliers from the north to the river Thames averages 5*s*. 6*d*. per ton, but these have to discharge their cargoes into barges to be conveyed to the respective coal-merchants' wharves, at an additional charge of 9*d*. to 1*s*. per ton. The craft proposed to be used on the canals and navigations would deliver at any wharf on the river Thames, docks, or Regent's canal; thus saving the coal-whippers' charge; care, however, must be taken that no craft be detained more than 24 hours after arrival, without demurrage being charged for delay, except per agreement; all coal-merchants find men to discharge craft. Should it be found, in working the mineral traffic, that more time is wanted to load and discharge the boats carrying coal, it would be met by having at least 3 or more boats, as might be required, at each end of the route. The steamer must not be detained longer than 24 hours without demurrage. The arrangement of extra boats would permit also a change of men (every mineral boat having 1 man attached to it), which wou d relieve those who worked the voyage up, and for which 7 men are sufficient for steamer and 3 towed boats with minerals. The rule to be observed being 4 men (including the engineer) with the steamer, 2 men with a fast-towed goods boat, and 1 man with each towed mineral boat; each of whom is occasionally changed on the voyage by a man from the steamer. It is also to be understood that men be provided to pass boats at locks, to give every possible expedition, so that the men navigating have nothing but their boats to attend to in passing locks. It will be found that men accustomed to working locks only, cause less damage to the works, and also increase the facility of boats passing through them.

We now give a calculation at the lowest rate of freight, carrying cargo but one way, returning empty; and taking the expenses at the extreme amount, showing an annual result:—Coal conveyed at 1 farthing

per ton per mile, for 200 miles, amounts to 4*s.* 2*d.* per ton; 200 tons by the steamer towing 3 other boats, each cargo being 50 tons, the freight will be £41 13*s.* 4*d.*; deduct from this £15 for the transit expenses both ways, and £10 for wear and tear of floating stock, amounting to £25 together, from the amount of the freight stated above, leaves profit on the trip of £16 13*s.* 4*d.*; multiply this amount by 313 working days in the year, will give £5216 13*s.* 4*d.* as the result of one trip per day continuously for the year. Any loading obtained to carry back, instead of returning light, whatever the amount of freight, will be additional profit to the above calculation.

The craft previously indicated will carry from 60 to 70 tons of coal or dead weight, although they are not calculated as carrying more than 50 tons each, therefore I am quite within estimate; the extra weight conveyed will pay any small extra expense, as towing lines, &c., which should be elastic, or attached to a spring fixed at the stern of each boat, to prevent any sudden or jerking action.

The rate of traveling is calculated at 5 miles per hour, or 40 hours for 200 miles, 24 hours to discharge cargo, 8 hours for taking in any back loading; they would return, being light loaded or empty, in 30 hours, making a total of 102 hours both ways, being 18 hours within the time stated of 5 days.

It occurs to me there is an unnecessary increase of expense in having engines of too great power; it may be very well for ocean vessels, but it is not required on narrow rivers or canals; engines of power sufficient to give the start to a train of boats, are more than sufficient to maintain the speed when once the impetus is given. The steady continuity of action of the screw propeller, and its submersion in the deepest portion of the canal, has more power than the paddle-wheel, working unequally in shallow water.

The navigations, &c. of the Aire and Calder, and also the Leeds and Liverpool canal, form one of the main routes, and are connected with districts abounding with heavy traffic, such as coal, limestone, stone, &c., for which it is of great importance to have facilities given, not only for the advantage of those two important navigations, but also as commanding a large heavy traffic that must pass south of these navigations, and thus affording the means of a paying traffic to the steamers employed on such improved routes, by ensuring them full cargoes at all times—a great point in carrying to be kept in view.

The improved canals, &c., must be their own carriers, the same as the railways, to meet the combined system adopted by them; at the same time, encouragement should be given to those persons that wish to cart to and from the station wharves, for the towns, &c., on the improved routes.

I have endeavored to give an outline of the improvements required on canals and navigations, to enable them to regain their traffic; also the kind of craft, engine, and propeller, best adapted to give the speed to meet competition.

I have witnessed the decline of canals with extreme regret, arising, as I think, from the want of zeal and energy to apply the scientific know-

ledge of the age, to meet the requirements of the enlarged and growing traffic of the country;—apathetically resigning into other hands the fruits of that original impetus which the canals first gave to the goods traffic of this great commercial country. JOHN ROBINS.

66 *Connaught-terrace, Hyde-park.*

APPENDIX.

In proof of progressive increase of traffic, compare the return of the Board of Trade, for the half-year ending December, 1856, with the return for the half-year ending December, 1855; showing the increase upon railways for the half-year ending December, 1856, as follows:—

	£	*s.*	*d.*
Increase on coal and mineral traffic,	283,093	6	5
" on merchandise,	173,282	3	1
" for half-year, ending December, 1856, of	£456,375	9	6
At the rate of £912,750 per year.			
" on cattle-traffic,	31,554	19	3
" on passenger traffic,	282,260	14	6
Total increase,	£770,191	3	3
At the rate of £1,540,382 per year.			

The following statistics show the extent of railway traffic; also the cost of their construction to compare with the cost of canal construction:—

	£	*s.*	*d.*
Dec, 1856, Total goods and mineral traffic, half-year,	£5,832,049	17	11½
" cattle " "	255,823	16	10½
" passenger " "	6,295,867	11	5
Total for all kinds of traffic,	£12,383,741	6	3

Working expenses, 47 per cent.; aggregate dividend, a trifle over 3 per cent.

RAILWAY CAPITAL, December, 1856.

Borrowed on loans, &c.	£57,057,171	0	0
" preference shares,	77,359,419	0	0
43 per cent. borrowed capital, paying 5·08 per cent. interest,	134,416,590	0	0
Share capital, subject to profit and loss,	174,359,304	0	0
Total,	£308,775,894	0	0
Cost of making English railways, per mile,	£40,288	0	0
" Scotch " "	£27,750	0	0
" Irish " "	£14,808	0	0

Total average expenditure per mile, £35,459. J. R.

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*Floating Tunnel across the Dover Straits.**

Our contemporary, the *Mining Journal*, gives the following statement regarding this great undertaking:—"The idea of connecting England with France by means of a railway has long been talked of, and it is more than 60 years since Mathieu first conceived the notion that a tunnel would be a desideratum; but carefully-made estimates are quite a

* From the Lond. Civ. Eng. and Arch. Jour., Jan., 1858.

novelty in the question. In opposition to the schemes of Thome de Gamond and the tubular bridge advocates, it is now said that something between the two—a floating tunnel—would be far preferable, since, even estimating the expense per foot run to be the same for the two new projects as for their respective originals—the Thames Tunnel and Britannia Bridge—the viaduct would cost £40,000,000, and the tunnel £90,000,000, whilst the following is the estimate given for the tube:—

One thousand cast-iron pipes, 600 tons each, at £6 10*s.* per ton,	£3,900,000
Wrought-iron bands, screws, bolts for the junction pipes, 15,000 tons, at £12 per ton,	180,000
Joining and sinking the pipes,	180,000
Three thousand cubes of concrete, each equal to 4096 cubic feet,	900,000
Three hundred spiricles, and their cubes and shrouds,	120,000
Wrought-iron bands, connecting the tunnel with the great cubes,	180,000
Abutments,	100,000
Rails, locomotives, cars, &c.	140,000
Other expenses,	300,000
Total expense,	£6,000,000

A railway is to run within this tube, which is to be above the bottom, but under the level of the sea. Throughout the greater part of its length it must not rest on the bed of the sea, but be supported by its own buoyancy; and this buoyancy is to be counteracted by iron bands connected with weights laid on the bottom of the sea. The tube will thus be put in the impossibility of rising to the surface as well as of sinking to the bottom, and the depth of immersion be so regulated as to afford the freest passage of any vessel. The external diameter of the floating tunnel will be 18 feet, and its average thickness 6 inches. This would be a more than sufficient strength, even if the tube had an ordinary annular section; it shall, however, be trebled by applying the cellular system. The weight of a cubic foot of sea water being 64 lbs., and that of cast-iron 454 lbs., we shall for the whole tube, in its length of a little more than 20 miles, have—

The weight of water displaced,	Tons,	782,000
Weight of tube,	"	600,000
Buoyancy,	"	182,000

The buoyancy is to be counteracted by cubes of concrete. The travelers in the floating tunnel will not be altogether deprived of the cheering benefits of the open air and daylight, for 300 large funnels, or spiricles, 10 feet in diameter, shall spring from the top of the tube, towering above the level of the sea. The whole floating tunnel shall be composed of 1000 cast iron pipes, of the aforesaid diameter and section. They will fit conically into one another, end to end, and their junction shall be strengthened and made water-tight by large bands of wrought iron, screwed and bolted to both elementary pipes on every line of junction."

Report of the Result of Observations upon the Deposit of Silt, in the Harbor of New York, made during the years 1854–1857. By CHARLES H. HASWELL, Civil and Marine Engineer.

A. B. NEILSON, Esq., President Board of Underwriters, New York.

SIR:—In the summer of 1854, I verbally called the attention of the late President of your Board, Walter R. Jones, Esq., to the wash of earth from the streets and sewers of this city and Brooklyn, into the slips bordering thereon, by which not only this harbor was being injuriously affected, but that the width of the channel inside of the bar at Sandy Hook had become seriously narrowed, and ultimately the depth of water on the bar must become lessened; and that, in view of the great interests that would be affected by any reduction of the depth of water there, it was proper that some investigation should be made of the extent of the deposit of *silt* into the rivers bordering our city, for the purpose of placing the results before the public, in order that its attention might be directed to the consideration of an element in our commercial position, secondary to none others, viz: the maintenance of a depth of water at the entrance of our harbor equal to the full requirements of our commerce.

Mr. Jones readily entertained my proposals, and under his direction I at once proceeded to make such observations as I thought best calculated to furnish the essential elements in the case, restricting myself to the subject of deposits in our harbor; the encroachment upon the boundaries thereof, by the extension of bulkheads and piers, and the injurious effects therefrom, I did not propose to consider, for the two-fold fact, that the necessity of restraining these encroachments had become so manifest to the public, that not only had the attention of our legislature been called to the subject, but that it was then receiving the consideration of a committee appointed for the purpose of investigating and reporting thereon; and, secondly, that the operation of such encroachment was so similar to that which I proposed to investigate, viz: the reduction of the tidal volume of our harbor, that the deductions in one case would be equally applicable to the other.

As a prelude to my task, I assumed it to be indisputable that the bar at Sandy Hook, in its general features, like the bars of all tidal rivers, presented a series of irregular obstructions stretching across the entrance into the lower bay, with a varying and less depth of water upon it than in the channels within it.

The causes admitted to produce this general result are numerous, but the following apply, in my opinion, peculiarly to the locality under consideration:

1st. To the arrest of the current of the last of the ebb tide from the bay, where it meets the first of the sea flood when it surrenders the *detritus* it holds in suspension.

2d. To the difference of the flood and ebb currents in their directions.

3d. To the action of ground swells from the sea, which, if heavy and flowing from the southward and eastward, deposit sand and gravel upon

the bar, and at all times, when aided by the current of the flood, within the entrance thereof.

4th. To the occasional diminution of the back water of the bays and rivers leading thereto from drought, and the reduction of the tidal volume by the presence of ice upon the flats and the shores.

5th. To a reduction of the tidal area by the constant accretion of *detritus* upon the shores.

The first three positions are similar, in a great degree, to those entertained by E. K. Calver, R. N. The fifth one by Sir Henry De la Beche.

In the prosecution of my observations, I selected sixteen locations which I thought best suited to furnish me with the elements desired, and providing myself with an equal number of bottles, of like capacity (30 inches), I repeatedly filled one of them with water from each of these localities at half tide (both ebb and flow), both in dry and wet weather, and at different seasons of the year; such water was then filtered, and the residuum weighed and noted in grains, the average results of which, deduced from the operations of several years, furnish the following:

Weight, in grains, of deposits in 30 cubic inches of water from the following localities:

	Grains.
Sandy Hook,	·109
Narrows,	·265
Robbins' Reef,	·367
Ellis' Island,	·811
Battery,	1·687
Liberty street,	6·927
Canal street,	8·531
Thirtieth street, west,	·937
Manhattanville,	·578
Harlem Bridge,	1·031
Hell Gate,	1·093
Thirtieth street, east,	1·265
Twenty-third street, east,	2·968
Grand street,	4·000
Wall street,	5·187
Broad street,	6·375

The mean result of which is 2·633 grains in every 30 cubic inches of water.

Excluding therefrom all the city localities, but one upon each side of it, for the purpose of arriving at a mean of the average presence of *silt* in the water of our harbor above the Narrows, the following result is obtained:

Narrows,	·265
Robbins' Reef,	·367
Ellis' Island,	·811
Battery,	1·687
Manhattanville,	·578
Harlem Bridge,	1·031
Grand street,	4·000
Thirtieth street, west,	·937
	8)9·676
	1·209

From which it appears that the average annual flow of *silt* into the rivers bordering this city, reaches the enormous rate of 1·209 grains in every 30 cubic inches of water; and, assuming the quantity of the former to be equal to 125 lbs. per cubic foot, a cubic inch of it will weigh ·072 lbs. The volume of this deposit, compared with water, is, therefore, as 1 to 12565.

Confining my observations to the city of New York alone, and taking the deposits shown in the water from the several localities around the city, the mean amount of *silt* in every 30 cubic inches of water is as follows:

Battery,	1·687
Liberty street,	6·937
Canal street,	8·531
Thirtieth street, east,	1·265
Twenty-third street, east,	2·968
Grand street,	4·000
Wall street,	5·187
Broad street,	6·375
Thirtieth street, west,	·937
	9)37·887
	4·209

Hence, by the elements before given, it appears that the volume of the deposit from the water in the slips of this city between Thirtieth street, east and west, and the Battery, compared with that of the water (at half tide), is as 1 to 3610.

Startling as these results appear, it must be borne in mind that they do not give a full exhibition of the facts of the case, for the observations made were necessarily confined to the presence of *silt*, and embraced only that portion which was retained in suspension by the flow of currents, whilst the deposit of *detritus* from the flow of gravel, sand, &c., could not be arrived at, unless by a different system of observation, and it is, consequently, not embraced in the above results.

The detractions from these results to be taken in view, are—

1st. That the strength of the current at certain points is sufficiently rapid to keep much of the *silt* in motion at both the ebb and flow of the tide; hence, although its presence is shown, yet its rapid deposit does not occur.

2d. That the water taken from the several locations between Thirtieth street, on each side of the city, was taken from between the piers; and, although the deposit of *silt* noted is just, as regards the location from where the water was taken, a greater deposit is exhibited than if taken from the ends of the piers; this, however, does not affect the results here given, but refers only to the extent of the area of deposit.

In corroboration of these results, and in illustration of the effects under consideration, the proprietors of the New York Sectional Dock assure me that the deposit of *silt* upon their tanks between the piers of Market and Pike streets, averages full five-sixteenths to three-eighths of an inch in one flow of tide, and they are thereby subjected to the delay and cost of dredging under their dock to the depth of seven feet every two years.

In illustration of the effects of a reduction by the encroachments upon our rivers, and the deposit therein, of the quantity of water which flowed into our harbor, the flood tide through the East river and Hell Gate once flowing to Sand's Point, is now arrested at Fort Schuyler; the width of the ship channel inside of the bar had narrowed in 1855 half a mile, since the survey of 1836; by a report of A. Boschke, of United States Coast Survey, made to Prof. A. D. Bache, the Superintendent thereof, it appears that in the main ship channel alone, from the S. W. Spit to Gedney's Channel, there has been an actual deposit in twenty years, of a volume of sand of 2,532,600 cubic feet; and from the late report of the Harbor Commissioners, made to the legislature of this State, it appears that the Jersey flats are rapidly silting up.

This is, in my opinion, an alarming exhibition, and one involving considerations demanding the immediate attention of all who feel interested in the commercial interests of this city; for, without remedial action, the width of the channel and depth of water on our bar will become so reduced as to preclude the admission of vessels of the largest size into our harbor.

The course of remedial action, most readily and effectually introduced at this time, that occurs to me, is the effective cleaning of our streets and piers, in order to remove the wash into the rivers therefrom, and putting an end to the present practice of depositing the dredging of our slips into the channel of the rivers; and I opine that no one who gives the subject his attention will, for a moment, permit the temporarily increased expenditure consequent upon the measure here suggested, to be weighed for a moment, or in value with the advantages to be derived therefrom.

The operation of dredging slips, as now performed, is briefly as follows: the deposits in the slips are removed to the channels of the North or East rivers, when the *silt* or mud is swept by the current of the tide back to the slips, and upon the flats of New Jersey and Long Island, and the stones, bricks and such other matter, too heavy to be moved by the detrial action of the current, fill the channel in proportion to their volume.

The opinion appears to prevail with the public, that the discharge from our sewers, and the deposits removed from the slips into the rivers, are washed, as it is termed, into the sea, and Long Island Sound; if this were the operation, it would be well for the interests involved in the subject under discussion; but, as it happens, a very brief examination of the case presents a very different result. Thus, the deposits in our slips, *i. e.* mud, independently of stones, bricks, &c., is composed of gravel, sand, clay, and feculent matter, which when transferred to the channels of the rivers is submitted to the detrital action of a current of from three to four knots per hour, eighteen miles distant from the sea; with these elements, then, it would be difficult to show how any portion of this mud, other than the soluble part of it, and the coloring matter therein, could ever reach Sandy Hook.

A view, then, of the elements submitted, and a consideration of their operations, furnishes the following deductions:—

1st. That the deposit of *silt* and *detrital* matter, into the rivers bordering this city, is so considerable in amount, that the slips of this city are very rapidly being filled, the bays, indentations, and flats upon the shores of Long Island and New Jersey, the Harlem river, and all places where the currents are comparatively feeble, are being rapidly silted up by the tidal currents, and along with the accretions of the wash upon the shores of our harbor, the tidal volume thereof is being reduced, upon the extent of which tidal volume, depend the volume of water passing the bar at Sandy Hook, a point involving the commercial value, if not the physical existence of this harbor.

2d. That the system of the dredging of our slips as now pursued, viz: the removal of the deposits therein from below low-water depth, to be exposed to the currents in the rivers, ends in but a transfer of them to other slips and shoal places; the effect of which is to involve the loss of time and cost of a re-removal of the deposits from the slips.

3d. That by the thorough cleaning of the streets and piers of this city, Brooklyn, and neighboring cities, the deposits into the slips would be lessened, and the necessity for dredging them would be rendered less frequent.

Finally: That economy in the current expenditures of cleaning our streets and dredging slips, demands that the streets and piers of our city should be thoroughly cleaned, and that the transfer of the materials dredged from our slips to the channel of the river should be forthwith forbidden, since the increased cost consequent upon the removal of the mud to the main land, is quite inconsiderable compared with that of its repeated removal by being deposited in the channels of the rivers.

In order that I may not be subject to the charge of attaching too much importance to this subject, I beg leave to submit a few of the results of investigations held by the Tidal Harbors Commission, &c., &c., &c., in England, together with the opinions of the necessity of the maintenance of the tidal volume in all maritime ports, as furnished by Calver in his valuable work upon tidal rivers, whose *thesis* is, "That the navigable condition of the outlet of a tidal river can only be maintained by tidal water, and that its extent as to sectional capacity will be proportioned to the amount admitted."

"We consider the magnitude of every tide harbor, both as to width and depth, is generally proportionate to the quantity of such flowing and reflowing water, and every subtraction from such quantity by embankment tends to decrease the magnitude of the outlet of the harbor."—Rennie & Jessop; Report on Rye Harbor; 1801.

"I am not aware that any remedy can be substituted for the deprivation of back-water."—Rennie; Report on Southwold Harbor; 1820.

"It is not to be forgotten that as the sands and mud accumulate, and marsh lands are formed in the upper part of the estuary, the power of scouring the lower portions (the entrance) is diminished."—Telford; Report on River Dee; 1821.

"If there were no receptacle for tidal waters to pass in and out at every tide, the harbor would cease to exist." "If with the same width between

the piers, we reduce the quantity of water which has to pass in or out in the same time, we diminish at once the required velocity or power to remove obstructions, and a decrease of depth follows almost immediately." "It is to be lamented that when the owners of estates were, perhaps, balancing in their minds whether the land they could reclaim would pay the expenses for reclaiming it, they were not advised of the injury they were about to do to the public and themselves by a reduction of the back-water, upon which their harbor is dependent."—Walker; Report of Southwold Harbor; 1841.

"Liverpool, Yarmouth, Montrose, and many of our great harbors, depend for their existence upon the tidal current, and therefore the receptacle for tidal water ought to be preserved with jealous care."—Walker; Report on River Tay; 1845.

Q. "Are the Commission to understand that inclosures stopping the flow of the tidal water, must gradually injure the bar of the harbor to which that formerly served as a scour?"

A. "Yes, it will do so."—Cubitt; Evidence before Tidal Harbors Commission; 1845.

"As the maintenance of the navigation and the keeping down the bar depends mainly on the quantity of water passing over it, * * * care should be taken that no further embankment over which the tide is accustomed to flow, be permitted. * * * * * On the contrary, care should be taken to increase, either in width or depth, the space for the reception of tidal water."—Sir John Rennie; Report on Wexford Harbor; 1831.

"I think that any effect from a fresh at the bar is a mere bagatelle compared with the scouring of tidal water."—Leslie; Evidence before Tidal Harbors Commission; 1845.

Q. "Are you of opinion that depths in rivers and their power of scouring are chiefly due to the volume of water brought down in freshes, or to the tidal waters?"

A. "I should say to the tidal waters."—D. Stevenson; Evidence before the Tidal Harbors Commission; 1845.

"I do consider it highly injurious to any river to shut out even one inch of the tidal water."—Bald; Evidence before Tidal Harbors Commission; 1845.

"The area of the estuary of the Dee was formerly about 12,000 acres, covered at every spring tide; of this space, 8000 acres have been enclosed, and the tidal water excluded. The act of Parliament that sanctioned this extensive encroachment, required that a depth of fifteen feet, at ordinary spring tides, should be maintained up to Chester; but the river was in so bad a state in December, 1844, that a vessel drawing only eight and a half feet water, could not go up to Chester on a spring tide."

"At Parkgate, twelve miles below Chester, which formerly was one of the principal mail packet stations between England and Ireland, a dry sand now extends almost across the estuary."—Second Report of Tidal Harbors Commission; 1846.

"Blackney and Clay, on the northeast of Norfolk, have a common entrance from the sea; within the memory of some of the present pilots, one hundred and forty coasting vessels have taken refuge in this port during one tide; yet in the place where these vessels lay afloat, at low water, there is now only a depth of four or five feet, and the utility of the harbor has consequently been almost destroyed."

"It is stated that this evil has been caused by the enclosure, at different times, of more than one thousand two hundred acres of land, over which the tidal waters formerly flowed."—Second Report of Tidal Harbors Commission; 1846.

"Rye Harbor has been ruined by embankments; it appears in evidence that formerly a sixty-four gun ship could use that harbor, which is now ruined."—Rennie; Evidence before Rochester Bridge Committee; 1820.

"Mr. Walker states in evidence before the Tidal Harbors Commission, the diminishing the reservoir for the tidal water in the Thames has had, in my opinion, the effect of increasing the shoals at its mouth;" and Mr. Abernethy, in his report upon the Dee, the enormous obstructions from which river we have already noticed, remarks, 'the lower portion of the navigation is gradually filling up;' thus proving the correctness of Telford's prediction."

Further: The fatal error of a common opinion, that the flow of water from the Hudson river, by freshets, is all sufficient to keep the bar at Sandy Hook navigable, is thus dissipated by elements furnished by Mr. Walker, in his evidence before the Tidal Harbors Commission.

In the Tay, the discharge, including that of the Earn, amounts, during freshets, to one million cubic feet per minute, or two hundred and forty millions during four hours. The tidal water passing Dundee in the same time is above seven thousand millions, or thirty times that of the river water, and making the calculation at the bar, the tidal water is upward of forty times that of the river water. It is well observed by Mr. Walker, that it is only when the quantities are reduced to figures in this way that the vast disparity is seen; and by Mr. Leslie, who says that any effect from a fresh at the bar is a mere bagatelle compared with the scouring of the tidal water.

Now, if this test of the measurement of the proportionate flow of the tide and of the freshets were made in the Hudson or Delaware, or any other of our tidal rivers of magnitude, a much greater disparity would be found to exist; for in this country, where the annual fall of rains is much below that of England, the volume of the river freshets would be proportionally decreased, which when estimated in connexion with the *datum* of Mr. Walker, above cited, would be conclusive as to the inefficiency of the scouring of a freshet, in comparison with that of the flow of the tides.

Regarding the effect of the presence of ice in a harbor, it must not be lost sight of, that although ice in suspension in the water does not reduce the tidal volume, other than by presenting a resistance to the surface current of the tidal flow; that when it is fixed, as when upon

flats and shores, it reduces the tidal volume in direct proportion with its own.

Trusting that the results furnished and the views here given will meet with your approbation, and a concurrence in the opinion as to the importance of the subject. I am, &c.

For the Journal of the Franklin Institute.

Experiments on the Strength of several kinds of Building Stone.

By R. G. Hatfield, Architect, New York.

[A paper read before the American Institute of Architects.]

The following are the results of experiments made within a few weeks to test the strength of such kinds of stone as are in common use in this vicinity in the construction of buildings.

The pressure applied was by means of a hydraulic press. This press was constructed for me by Messrs. R. Hoe & Co., in their best style of workmanship; oil instead of water is used to avoid corrosion, and consequent friction. The pressure is indicated at all stages of the experiment by an index moving over a scale on a circular arc; the index being operated by levers on knife-edge bearings; one of these levers is pressed by a piston playing in a small cylinder, the piston being operated by the oil under pressure. The press has a capacity of 60,000 pounds.

In the experiments recorded below, I was kindly assisted by our fellow member, Mr. Welsh, who contributed many of the specimens.

The Resistance to Crushing.—The specimens submitted to this test were two inch cubes of freestone. They were dressed to the shape about as accurately as cut stone used in the erection of buildings. To prevent any unequal pressure on the parts, they were bedded above and below in a thin layer of fine white sand. The results given below are the pounds per square inch of the surface pressed, required to produce the first fracture.

Kind.	Number of Specimens.	Average resistance per square inch.	Specific Gravity.
Belleville, N J.,	4	3522	2·328
Connecticut,	3	3319	2·452
Dorchester,	2	3059	2·381
Little Falls,	5	2991	2·326
Caen,	4	1088	2·218

Resistance to Cross Strain.—The specimens submitted to this test were about 4×6 inches, and 16 inches long; laid on chairs with a clear bearing of one foot in length. The figures given below are the reduced results, and exhibit for eachkind the constant, s, in the formula $\frac{l\,w}{b\,d^2} = s$, or the weight required to break a piece of the material one inch square,

and one foot long, clear bearing, the weight concentrated at the middle of the length.

Kind.	Number of Specimens.	Average valve of $s = \frac{l\,w}{b d^2}$.	Specific Gravity.
Blue stone flagging,	3	125 lbs.	2·707
Quincy granite,	2	104	2·658
Little Falls freestone,	3	96	2·326
Belleville "	3	82	2·328
Granite (blue,) (Another Quarry.)	1	72	2·604
Belleville freestone,	3	71	2·273
Connecticut "	3	52	2·462
Dorchester "	3	43	2·289
Aubigné "	2	37	2·472
Caen "	3	25	2·218

The one specimen of granite giving a result so much below that of the other two specimens, was of a coarse texture, showing in the fracture the crystals of its ingredients large and distinct in form and color.

New York, January 19, 1858.

AMERICAN PATENTS.

List of American Patents which issued from December 1st, to December 29th, 1857, (inclusive,) with Exemplifications.

DECEMBER 1.

1. For an *Improvement in Knitting Machines;* Walter Aiken, Franklin, N. H.

Claim.—"A set or series of traversing needles arranged to slide independent of each other, in combination with the stationary plates between the needles to hold the fabric knit, when the stitches are formed, constructed, and operating as described. Also, a vibrating traversing yarn carrier, operated so as to hold the yarn over or near the selvage, while the carrier is vibrated so as to change the latch opener. Also, a double edged latch opener, in combination with a vibrating yarn carrier, operated so as to change the latch opener. Also, the stationary rocker or supporting bar, so constructed and arranged as to support the outer ends of the needles beyond the fabric, and under the latch opener."

2. For an *Improvement in Ploughs;* Joseph Banks, Dadeville, Alabama.

Claim.—"The arrangement of the double branched colter, so that its rear branch rests on the point or share, and its forward branch supports the under side of said point, in combination with the vertical, and forward, and rear adjustments of the colter in the beam."

3. For an *Improvement in Speed Indicator;* James M. Benckert, Philadelphia, Pa.

Claim.—"The arrangement of the double threaded cam, segments, and swivel arm."

4. For an *Improved Surveying Level;* Christopher Becker, Brooklyn, New York.

"This improvement consists in the simplicity and greater accuracy of my instrument in the manner of supporting the telescope, the arrangement of the spider's thread, and

in the construction of the tangent and micrometer screws, as well as in the arrangement of setting the instrument by the application of screws directly upon the conical axis of the same."

Claim.—"1st, The constructing of the telescope with square surfaces, resting upon small points or surfaces upon the supports, and attached to the same. 2d, The arrangement, construction, and manner of operating the spider threads by one screw only. 3d, The arrangement of the set screws, acting directly upon, and square to the axis of, the instrument. 4th, The arrangement and construction of the micrometer and tangent screws, so as to prevent any dead movement."

5. For an *Improvement in Composition Fuel;* Elizabeth Billinger, Mohawk, N. York.

Claim.—"The inflammable composition formed by the union of kauri gum, rosin, and saw-dust, in suitable proportions to give it the character specified."

6. For an *Improvement in Seeding Machines;* Jarvis Case, Springfield, Illinois.

Claim.—"So combining with the driver's seat, a marker, having in its arm a hinged brace, or its equivalent, as that said driver may, from his seat, turn over or reverse said marker, suspend it to the machine whilst turning around, and drop it into its working position, without leaving his seat on the machine."

7. For an *Improvement in Hay Rakes;* L. A. C. Brown, Sparta, Illinois.

Claim.—"Operating or raising the rake through the medium of the lever, provided with the pin, the wheel, and the curved bar."

8. For an *Improvement in Sewing Machines;* Joel Chase, City of New York.

"My invention consists in a certain combination and arrangement of parts, for causing the needle to feed the cloth forward."

Claim.—"The combination of the lever when hung on an axis in the rock shaft with the lever, when the motion thereof is limited by the stops, for the purpose of imparting the feed motion to the needle."

9. For an *Improvement in Extension Tables;* Charles B. Clark, Mount Pleasant, Iowa.

Claim.—"Having the jointed or folding side rails, made of unequal lengths, and applied to the end pieces."

10. For an *Improvement in Mechanical Movements for Regulating the Action of a Fly-wheel on the working parts of Machinery connected with it;* Abram C. Frederick, Clarendon, New York.

Claim.—"Attaching a fly-wheel to the machinery upon which it is intended to concentrate its force, by the medium of a friction brake."

11. For an *Improvement in Seeding Machines;* Jacob Geiss and Jacob Brosius, Belleville, Illinois.

Claim.—"The employment or use of the two sector plates, one being provided with an opening, and the other with a recess or seed receptacle and ledge, the plates being fitted on a common axis, and operated through the medium of the eccentrics, and the connecting rods attached to the arms at the desired points."

12. For an *Improved Rake for Harvesters;* C. P. Gronberg, Geneva, Illinois.

"My improvement consists in a new and peculiar mode of operating automatic rakes, by which the grain is raked off the platform and deposited in a neat and compact gavel at the side or in the rear of the machine farthest removed from the standing grain."

Claim.—"The guide rods and swinging frame carrying the stationary fork, in combination with the levers and traveling fork."

13. For an *Improvement in Cooking Stoves;* Rensselaer D. Granger, Philadelphia, Pennsylvania.

Claim.—"Forming underneath the oven a chamber, through which a current of cold air entering at the rear of the stove, may pass into the space between the back of the fire place and front of the oven, when the said chamber serves the purpose of dividing and dispersing the products of combustion as they pass through the flue to the chimney."

14. For an *Improved Pile for Rolling Beams;* John Griffin, Phœnixville, Penna.

Claim.—"The manufacture of wrought iron ⌶ or T girders and bars, by forming the pile of grooved pieces, in combination with the intermediate webbing."

15. For an *Improvement in Cultivators;* Joshua Gibbs, Newark, Ohio.

Claim.—"A cultivator having its frame made of wrought iron, with metallic lipped plates made to slide longitudinally on the frame, attached to the plates by bolts, and capable of being adjusted and reversed."

16. For an *Improvement in Long Trunks for Cleaning Cotton;* Isaac Hayden, Lawrence, Massachusetts.

Claim.—"Covering the partition of an elongated trunk or box for cleaning cotton and other fibrous substances with woven wire, having the scores formed by the weft crossing the warp of said wire screen filled with metal or cement."

17. For an *Improvement in Dumping Car;* George W. Hart, Aurora, Indiana.

Claim.—"In combination with the reel, the slatted folding floor."

18. For an *Improved Printing Press;* John Henry, Vevay, Indiana.

Claim.—"1st, The frisket carriage attached to the frame, and used in connexion with the inclined bars or guides, whereby said frisket carriage and its frisket is elevated at the termination of the outward stroke of the frame, so that a blank sheet may be readily and conveniently adjusted on the frisket, or a printed sheet may be discharged therefrom. 2d, The frisket, when used for the purpose of discharging or delivering a printed sheet. 3d, The combination of the pressure cylinder and frame, when said cylinder is operated automatically by the wedges and spring, so as to be depressed at the proper time, and give the necessary impression to the sheet; and also be thrown up free from the sheet after the impression has been given. 4th, The arrangement of the feed-board and fly-board, when arranged so that said boards are made adjustable and capable of being removed at one side so as to render the working parts of the press accessible."

19. For an *Improved Machine for Sawing Beveled Curves;* John C. Hintz, Cincinnati, Ohio.

Claim.—"1st, The cranes, with the traversing and turning rests, communicating with a winch, or its equivalent, convenient to the hand of the sawyer, in combination with a scroll saw and feed roller. 2d, In this connexion the rest."

20. For an *Improvement in Corn Harvesters;* Adam Humberger, Somerset, Ohio.

Claim.—"The large shafts or rollers turning upon the fixed axle, and having radial arms with knives, in combination with the guards and knives, for the purpose of cutting the stalks, and securely conducting them across the table to the binding table. Also, the table, when movable upon its supporting frame, in combination with lever and clamps for binding and shocking the corn."

21. For an *Improvement in Revolving Bottle Casters;* Edward Gleason, Dorchester, Massachusetts.

Claim.—"The combination of the pinions, each moving a caster door and cruit, and the wheel, with the pinion of the rod or arbor, the said pinion gearing into a segment rack in the wheel, so that when this combination is actuated through the knob, the caster cruits, and doors to which they are attached, may be rotated independently of the rotation of the body of the caster."

22. For an *Improved Balance Iron for Mill Stones;* Joseph H. Glover, Skeggs' Creek, Kentucky.

"This improvement consists in having an adjustable block arranged within the bail."

Claim.—"The block, when made adjustable from the exterior of the bail, by means of screws."

23. For an *Improved Standard for Seats;* John Irwin, Philadelphia, Pennsylvania.

Claim.—"The combination of the screw and spring, forming an improvement in adjustable and elastic standards for seats."

24. For an *Improvement in Gang Ploughs;* Edward C. Jones, Pittsburgh, Penna.

Claim.—"The arrangement of the hinged beams and springs, or any equivalent device therefor. Also, the coupling of the ploughs to a front bar and back bar, which bars can be raised or lowered by means of the rack rods and segment levers, or any equivalent means in their place."

25. For an *Improvement in Ploughs;* John Lane, Jr., Lockport, Illinois.

Claim.—"The rigid foundation or frame, when constructed with a taper point and inclined flanch, which projects nearly at right angles from the land side of the plough, underneath the mould-board and lay, for use in combination with a yielding mould-board, a yielding steel lay, which has a complete taper socket at its point, and with a steel land side facing."

26. For an *Improved Pedal Base for Melodeons, &c.;* George W. Lane and Wm. N. Manning, Rockport, Massachusetts.

Claim.—"1st, The arrangement of the valves, the reeds, and the air chamber of the pedal base upon the pedal board, or otherwise in an equivalent manner arranging the same behind the pedals, so that the whole of the pedal base is rendered portable, and can be attached to any instrument by simply connecting its air chamber by a pipe with the bellows of an instrument. 2d, The arrangement of the valves with their lever-like stems, inclined planes and springs, for the purpose of combining the valves with the pedals to be operated thereby."

27. For an *Improvement in Railroad Car Wheels;* A. B. Latta, Cincinnati, Ohio.

Claim.—"The wheel constructed as represented in its parts, for the purpose of producing a tension stress on the dished wrought iron plates, for binding the rim together by drawing the plates apart in the centre, and holding them by the ring."

28. For an *Improvement in Machine Banding;* Charles Lenzmann, Brooklyn, New York.

Claim.—"The machine banding."

29. For an *Improvement in Finger Bars for Harvesters;* J. M. Long, Peter Black, and Robert Allstatter, Hamilton, Ohio.

Claim.—"The combination of the wrought metallic plates, with the reciprocating cutter bar, cutters, and square shanked fingers, said parts being constructed and arranged in relation to each other for joint operation."

30. For an *Improvement in Cane Planters;* Tobias Marcus, City of New York.

Claim.—"The adjustable mould-board arranged and operated by means of the circular slide, in combination with the adjustable beam and socket secured by braces."

31. For an *Improvement in Bee-hives;* Henry McClellan, York, Pennsylvania.

Claim.—"The combination of the sections with rotating doors, agitating and regulating wires, ventilating tubes, and tolling and feeding cups."

32. For an *Improvement in Machines for Rolling Dough;* John McCollum, City of New York.

Claim.—"The combination with rollers suitable for rolling dough, or similar substances, of an endless feeding board or platform moving on pulleys or friction rollers, for the purpose of feeding the dough to the rollers as required, the band not being geared to the rolls in any way, and being free to take its motion from the dough."

33. For an *Improvement in Egg Beaters;* Harvey Miller, Cincinnati, Ohio.

Claim.—"The frame having a ratchet bar and revolving beater, in combination with the jar or can."

34. For an *Improvement in Lifting Jacks;* David L. Miller, Madison, New Jersey.

Claim.—"The adjustable cylinder, shoe, inner cylinder, or adjustable standard, in combination with the main or lifting screw, and gearing."

35. For an *Improvement in Grain Separators;* John R. Moffit, St. Louis, Missouri.

Claim.—"The construction and arrangement of the rotary beater within the apron, in combination with the falling sections."

36. For an *Improvement in Seed Planters;* Daniel B. Neal, Mt. Gilead, Ohio.

Claim.—"The peculiar arrangement of handle, rod, bars, slides, and lever."

37. For an *Improvement in Rock Drills;* Joseph E. Nesen, City of New York.

Claim.—"Attaching the semi-circular slotted plates and frame to the adjustable frame, fitted to the uprights of the frame."

38. For an *Improvement in Lime-kilns;* Jacob Newkirk, Factoryville, New York.

"This invention relates to the peculiar manner of carrying up the flame and heat into the arch, and thence by cross-flues into the kiln or stack."

Claim.—"Instead of taking the upper fire-flues directly from the fire chamber into the interior of the kiln, the carrying a portion of the flame and heat up into the arch, and thence by the upper flues into the stack or interior of the kiln, by which means I economize and make a better distribution of the heat, and better draft than when it is taken alone, and immediately from the fire chamber."

39. For an *Improvement in Seeding Machines;* David O. Paige and John Cary, Dayton, Ohio.

"The object of this invention is to prevent the discharge orifices of the seed box from choking or clogging, and thereby effect a free and even discharge of the seed therefrom."

Claim.—"The spiral flanches, placed in reverse positions on the rotating cylinders within the hopper."

40. For an *Improvement in Cotton and Hay Presses;* George W. Penniston, North Vernon, Indiana.

Claim.—"Connecting each of the ropes which operate the toggle, to which the press and draw-back, the plunger to separate, and independent capstan barrels arranged to turn freely on the same shaft, provided with a device to lock either of them to said shaft when desired, so as to save three-fourths of the time heretofore required to retract the press, and the time and labor of reversing the horse twice for each bale pressed."

41. For an *Improvement in Railroad Car Wheels;* Michael Phelan, Bridgewater, Pa.

Claim.—"The curved projections on the disk, of four reversed sines forming arms, in combination with braces and a series of arches, so arranged on the disk or front plate of four reversed sines, so as to give a uniform spring to all parts of the casting in cooling, relieving the wheel from all contingent strain, and giving the greatest possible strength for the weight of iron used, and for the application of said curved projections, and combination of arches and braces, without a front plate in casting car wheels."

42. For an *Improvement in Corn Planters;* Bradley L. Prime, Hamilton, Ohio.

Claim.—"The yielding partitions of the hopper, in combination with the secondary projections of the cam wheel."

43. For an *Improvement in Corn Harvesters;* John H. Rible, Somerset, Ohio.

Claim.—"The combination of the bed and arms with the movable carriage, or its equivalent, so as to receive the cut product and deposit the same. Also, the re-entrant reel, in combination with the receiving apparatus."

44. For an *Improvement in Machines for Making Brooms;* Spencer Rowe, Baltimore, Maryland.

Claim.—"The employment of the double pawl operating on the ratchet wheels, and hollow shaft, the rock shaft, and rods, when in combination with the guide and friction spools, and bobbin, for the purpose of manufacturing corn brooms in a superior manner."

45. For an *Improvement in Riding Saddles;* Joseph Rudisill, Natchez, Mississippi.

Claim.—"The peculiar arrangement of a series of light flat springs, in a circular line round the upper side of the cantel foundation of the tree, for use, in combination with the coiled spring as peculiarly arranged under the head of the tree, said springs being actuated simultaneously by means of the seat and webbing or foundation."

46. For an *Improvement in Seed Planters;* John Robinson of Eli, Sharpstown, Md.

Claim.—"1st, Regulating the quantity of earth deposited over, and adjacent to, the seed, by means of adjustable stops, when used in connexion with the curved arms, lifting arms, and adjustable strap, in connexion with the adjustable coverer. 2d, The combined arrangement of the vibrating box, lifting arm, adjustable strap, and adjustable stop."

47. For an *Improvement in Work Boxes;* Charles C. Schmitt, City of New York.

Claim.—"A work box and escritoire, constructed as herein described, viz: the hinged

or folding front side, provided with the flap, the recesses in the top to receive the writing and sewing implements, the secret drawers, concealed by the sliding plate or bottom."

48. For an *Improvement in Spreading Lime and other Fertilizers;* Pierpont Seymour, East Bloomfield, New York.

Claim.—"The combination and arrangement of a series of vibratory plates or distributors, attached to, and working upon, the face of an inclined plane or distributing surface, by means of the rod, or any equivalent connexion that will give the required motion to one end of said plates, while another portion is stationary upon the board or plane."

49. For an *Improvement in Cultivators;* A. Quarles Withers, Red Banks, Mississippi.

Claim.—"Hanging the stock bars to the frame by hinge joints, so as to give them a vibratory play sidewise."

50. For an *Improved Machine for Threading Bolts;* William Sellers, Philadelphia, Pennsylvania.

"The object of my invention is to avoid the necessity of reversing the motion of the cutting dies, or of stopping the machine to change the bolts, and to so arrange the die and tap holder, as to admit of greater facility in changing from one size thread to another, or to tapping nuts."

Claim.—"The use of a die-box and cams, when these are so arranged as to be capable of revolving about a common centre at different velocities, for the purpose of opening and closing the dies. Also, arranging the cams so as to leave open spaces between them, in combination with the die-box and dies, to facilitate the changing of the dies. Also, the mode of attaching the tap holder to the revolving die-box."

51. For an *Improvement in Ploughs;* Wm. W. Skinner, Davenport, Iowa.

Claim.—"The mould-board, friction roller, rotary cutter, wheels, adjusting lever, and seat."

52. For an *Improved Clothes Wringer;* Riley Smith, Towanda, Pennsylvania.

Claim.—"In combination with the cloth bag or net, that contains the clothes that are to be wrung, a twisting or wringing device, composed of a cord and lever, when said cord is united to, or winds around, the clothes receiver, and the lever can slide thereon, so as to apply the greatest pressure nearer the centre of the clothes receptacle, and moved where most desired or required."

53. For an *Improvement in Sausage Machines;* W. Sniff, Fultonham, Ohio.

Claim.—"The stuffing device formed of the cylindrical trunk, provided with slots, and the plunger attached to the rod, when the above parts are arranged relatively with the box of the cutting device, so that the parts may operate conjointly."

54. For an *Improvement in Clasps for Metallic Hoops;* James R. Speer, Pittsburgh, Pennsylvania.

Claim.—"The use of a hollow clasp or fastening for metallic bands, through which the ends of the hoop are passed in opposite directions, and the projecting extremities bent over the clasp, and inserted into an aperture in the middle of the clasp."

55. For an *Improved Photographic Plate-holder;* John Stock, City of New York.

"This invention consists in the construction of a plate-holder, to which sliding pieces are fitted, capable of being moved in or out to accommodate any size glass or plate, said pieces being provided with suitable recesses and flanches to receive and support the glass or plate."

Claim.—"1st, A plate-holder for photographic or other purposes, with movable pieces to support the glass or plate, for the purpose of accommodating different sizes of plates. 2d, The plates acted upon by springs, for the purpose of keeping the pieces in any desired position."

56. For an *Improvement in Propelling Cars and Carriages by Horse Power;* Henry G. Vanderwerken, Greenbush, New York.

Claim.—"1st, So arranging the endless belt platform on a frame independent of the truck, that the return part or underside of the belt may rest upon, and gear into, pinions

on one or both axles, and thus cause them to rotate in the direction in which the horse is apparently walking, without the use of any intermediate gearing. 2d, Supporting the endless belt platform on the axles of the truck, in such manner that when the horse is at work, it will assume an inclined position, and when at rest a horizontal one."

57. For an *Improved Machine for Moulding Shells;* W. H. Ward, Auburn, New York.

Claim.—"1st, Adjusting the semi-flasks to the pattern, to the moulding bed, and to each other, by means of a circular V shaped guide. 2d, The combination of the V guides with the ribs and the recesses in the base of the flask for adjusting the pouring tube to the gate pattern. 3d, The combination of the adjusting screws in the base of the pattern, with the adjustable eccentric rod, for adjustang and raising the pattern so that its centre will coincide with the plane of the moulding plate. 4th, The combination of the core pin and adjusting flanch, with the core pin holder and adjusting recess."

58. For an *Improvement in Ploughs;* Robert B. Winston, Richmond, Virginia.

"This invention consists in the peculiar set of the beam, and also in the arrangement for the easy adjustability of the handle."

Claim.—"The construction of the beam, in combination with the land-side, when the said beam is cast in one piece with the land-side."

59. For an *Improvement in Gas Lighting Lanterns;* Abel Wilson Philadelphia, Pa.

Claim.—"Surmounting the body or casing of a lantern, with a hollow perforated cone situated within the exterior cone."

60. For an *Improvement in Driving Box for Locomotives;* John E. Wootten, Philadelphia, Pennsylvania.

Claim.—"The adjusting plate, or its equivalent, in combination with the divided journal box."

61. For an *Improvement in Machinery for Cleaning the Top Cards of Carding Machines;* Horace Woodman, Biddeford, Maine.

"This improvement consists in the greatly improved and perfected machine, by which the top cards are in turn raised, cleansed, and restored to their seats, and the movement of the cleanser frame are effected."

Claim.—"The peculiar construction and arrangement of fixed corrugated arches, and traversing corrugated arches with gears. Also, the peculiar construction and arrangement of tangent pinion, with section of teeth and cavities at its ends, operating in combination with the plane face of gear. Also, the said jointed lifters."

62. For an *Improvement in Mowing Machines;* Ephraim Ball, Canton, Ohio, Assignor to self and John Butler, Buffalo, New York.

"My invention consists in a peculiar manner of attaching the finger bar to the frame of the machine."

Claim.—"The combination of the short curved brace rod, with the rigid and broad angle attachment of the inclined bar to the finger bar, the whole arranged for joint operation."

63. For an *Improved Treatment of Ores of Gold and Silver;* Joseph A. Bartola, Assignor to self and John Stagg, City of New York.

Claim.—"The use of pyroligneous, acetic, or other vegetable acids, having similar chemical action in treating gold or silver ores or 'tailings,' preparatory to amalgamation."

64. For an *Improved Device for Fastening Harness Traces;* Joseph W. Briggs, Cleveland, Assignor to Judson A. Lazell, Plainville, Ohio.

Claim.—"The raised or elevated parts of the trace, when used in combination with a cam lever."

65. For an *Improvement in Cleaning Gas Retorts;* Simmons W. Carpenter, Assignor to Wm. W. Woodworth, Yonkers, New York.

Claim.—"The method or process of the introduction of water directly into the heated retort (the charge being drawn or exhausted), there to be converted into steam or stame,

free to unite with and remove the carbonaceous or other deposit contained in the retort or pipe."

66. For an *Improvement in Knitting Machines;* Sherman D. Fairbanks, Assignor to self and Charles H. Adams, Cohoes, New York.

Claim.—"A latch interceptor, consisting of a bar or arm, arranged in such a position over the needles as to intercept the latches after they are opened or thrown back by the stitches of the fabric knit, and hold them open until the yarn is supplied to form new stitches, and then allow them to be closed again. Also, in combination with the interceptor, the yarn carrier, for the purpose of delivering the yarn."

67. For an *Improvement in Sewing Machines;* George Fetter, Assignor to self and Edward Jones, Philadelphia, Pennsylvania.

Claim.—"The needle bar with its adjustable lever, in combination with the slide and its projections, the whole being arranged for joint operation."

68. For an *Improved Paint Vehicle;* Isaac Gattman, Assignor to self and Jacob and David E. Breinig, Philadelphia, Pennsylvania.

Claim.—"The employment of the alkaline salts of the fatty acids (oleate, margarate, sterate of potash, soda, and like substances), in combination with resin and oil as a thinner for paints instead of oil."

69. For an *Improved Card Printing Machine;* James S. Moody, Assignor to T. F. and J. F. Randolph, Cincinnati, Ohio.

Claim.—"The arrangement of the arm when provided with the form, distributing plate, rods, feed plate, duct, guide plate, spring, and lever, and these arranged with the levers and spring, when said levers are furnished with ink rolls and distributing rolls, and the whole arranged with the vertical oblong openings in the lower part of the frames, in which the shaft works to admit of the arm being raised vertically to make an impression by pressing down the end of the lever on the fulcrum, and thus elevating the arm as before stated, the whole thus combined, arranged, constructed, and operated as represented, in the manner and for the purposes of feeding blank cards to the machine, inking the form, making the impression, and discharging the card from the machine after being printed."

70. For an *Improvement in Machines for Shearing Cloth;* Milton D. Whipple, Charlestown, Assignor to A. B. Ely, Boston, Massachusetts.

Claim.—"Removing the rest away from beneath the shearing knives, and holding the cloth against the ledger blade by tension."

DECEMBER 8.

71. For an *Improvement in Churns;* Benjamin Beers, New Fairfield, Connecticut.

"This invention consists in a revolving dasher with spring floats so arranged that they are rigid when the dasher is turned in one direction to churn the cream, and yield or give way when the dasher is turned in the opposite direction to gather and amass the butter, so that the buttermilk can be drawn from it."

Claim.—"A rotating dasher with spring floats, constructed and arranged substantially as described, so as to churn the cream and work the butter."

72. For an *Improvement in Corn Planters;* J. H. Bonham, Elizabethtown, Ohio.

Claim.—"The conical seed reservoir, in combination with the caps or disks, operated by the handle. Also, the conducting spout, in combination with tilting pins and block or bottom."

73. For an *Improvement in Billiard Table Cushions;* John M. Brunswick, Cincinnati, Ohio.

"This invention consists in the use of cork, rubber, paste-board, and leather, for forming the body of the cushion, when used in the order enumerated from the rail to the face of the cushion."

Claim.—"The combined use of cork, rubber, paste-board, and leather, when used in the order herein enumerated."

74. For an *Improvement in the Cutting Apparatus of Mowing Machines;* Chester Bullock, Jamestown, New York.

Claim.—"1st, The mode of attaching the cutters to guard teeth and to the cutter bar,

in combination with the shortened lip, by which I am enabled to readily detach said cutters for grinding or for other purposes. 2d, A hollowed cutter, so arranged in connexion with other parts as to present the same, or nearly the same, cutting angle in every part of the stroke, when the teeth are hinged to their axis forward of the cutting parts."

75. For an *Improvement in Mode of Treating Flax, Hemp, and other Fibrous Material;* John W. Burton, Eye, and George Pye, Ipswich, England; patented in England, March 20, 1856.

Claim.—"The mode of treating flax—or fibrous matters requiring like treatment—the same consisting in subjecting such to the action of a press, and to water impregnated with fullers' earth, and heated or boiled."

76. For an *Improvement in Seed Planters;* James Carroll, Laporte, Ohio.

Claim.—"The employment of the handle furnished with a discharge passage, in combination with a slide which has a hand trigger, and with the peculiar conducting tube which is furnished with shares."

77. For an *Improvement in Ploughs;* Jarvis Case, Springfield, Illinois.

Claim.—"Hinging the tongue to the beam of a plough, and extending a lever or lever seat from one to the other, so that the driver mounted on the plough may by said lever throw the plough or ploughs out of the ground. Also, supporting the front of the beam on the centre of an axle supported in wheels, so that said beam may be raised or lowered on said axle, but not affected by the passing of said wheels over the rough ground."

78. For an *Improvement in Agricultural Forks;* Charles, Abram, and C. N. Clow, Port Byron, New York.

"This invention consists in employing a peculiarly constructed head, and in the manner of attaching the bow to the head, so as to permit its being turned down on the tines to facilitate packing."

Claim.—"Jointing the bow on to the head."

79. For an *Improvement in Billiard Table Cushions;* H. W. Collender, City of New York.

Claim.—"The use of two rubbers possessing different qualities or degrees of elasticity, for the purpose of producing a rubber spring cushion with a comparatively solid rubber face, and an elastic rubber back."

80. For an *Improved Planing Machine;* John D. Dale, Philadelphia, Penna.

Claim.—"1st, The arrangement by which the support rollers and the feed roller are raised, and the carriage simultaneously secured, whereby I make a permanent bed and continuous feed, and by lowering the same, I make a reciprocating moving bed plate or carriage, and am enabled to change from one to the other at the will of the operator. 2d, The arrangement whereby an adjustable cutting bed is formed on the end of the movable carriage. 3d, The combination and arrangement of the method for attaching side cutters, by which they are both rendered adjustable. 4th, The particular arrangements, in combination, by which the pressure bar and the transverse bar are made to raise, and by which they are made to correspond with the circumference of the rotary cutter, by raising the superior feed roller."

81. For an *Improvement in Sewing Thimble;* John Devlin, Philadelphia, Penna.

Claim.—"The application of a guard or fender to the outer side of a sewing thimble."

82. For an *Improved Machine for Boring Hubs;* Zina Doolittle, Perry, Georgia.

Claim.—"The employment of a hollow shaft, the rod, and the projection, with the nut, for the purpose of expanding the cutter."

83. For an *Improvement in Life Preservers;* Abram J. Gibson, Worcester, Mass.

Claim.—"A life preserver composed of a belt, arm floats, and buoyant paddles, and furnished with straps, or their equivalents, to attach it to the person."

84. For an *Improvement in Piano-Fortes;* H. Goldsmith, Philadelphia, Pennsylvania.

Claim.—"The additional or supplemental sounding board. Also, in combination with said sounding board, the contracting of the bridge, so as to allow of the treble and tenor

strings being all brought more nearly together upon the same, whilst they are at the same time permitted to retain the usual distances apart on the pin block."

85. For an *Improved Machine for Cutting Metallic Bars;* Samuel Hall, City of New York.

Claim.—"The employment of one or more revolving shear blades, fastened to the end or face of a revolving hollow cylinder, in combination with a stationary shear blade."

86. For an *Improved Printing Press;* Charles W. Hawkes, Boston, Massachusetts.

Claim.—"1st, The cam lever operated by a vibrating platen. 2d, Securing carriage ways to the adjustable bed, so that when the bed is moved, by altering the impression the roller carriage will move with it, and keep the rollers always in a proper position to roll the form evenly, in combination with the roller carriage. 3d, The nipper lever. 4th, The trip, in combination with the nipper lever. 5th, The combination and arrangement of mechanism for receiving the cards to be printed, and delivering them after they are printed."

87. For an *Improvement in Harvesters;* Seymour Johnson and Leicester Johnson, Jr., Avon, New York.

Claim.—"The arrangement of the outer wheel, drive-wheel, and inner wheel, in combination with the adjustable draft pole, and movable blocks."

88. For an *Improvement in Propellers;* Almer Johnson, Buffalo, New York.

Claim.—"Constructing propellers."

89. For an *Improvement in Bee-hives;* Samuel Kelley, Washington, D. C.

Claim.—"The sliding frames, removable pins, and dividing zinc plates, in combination with the movable passage ways and the sliding valve."

90. For an *Improvement in Securing Hatches of Vessels;* Edward S. Keyser, City of New York.

Claim.—"The securing of ships' hatches, and making the joints water-tight, by means of the hollow flanched ribs, and the rubber and plate contained within it, which are pressed down over the seams or joints by the screws."

91. For an *Improvement in Sewing Machines;* Wm. H. Lazelle, City of New York.

Claim.—"The disk to which the needle arm is rigidly attached, provided with its bosses or friction surfaces, in combination with a plane-faced disk cam."

92. For an *Improvement in Lamps;* Francis Leclair, City of New York.

Claim.—"The shield, constructed so as to be held in its position by the screw, and operating between it and the top of the reservoir."

93. For an *Improved Arrangement of Life and Treasure Buoy for Vessels;* Francis D. Lee, Charleston, South Carolina.

Claim.—"The arrangement of the buoy, provided with the means and appliances in relation to the chest or safe and indicating buoy, and the decks of the vessel."

94. For an *Improvement in Ploughs;* Joel Lee, Galesburgh, Illinois.

Claim.—"The combination and arrangement of the two wheels attached to the different sections of the beam, swiveling quarter around in opposite directions, and bracing the plough."

95. For an *Improvement in Seed Planters;* Joel Lee, Galesburgh, Illinois.

Claim.—"The bevel wheels, when combined with the swivel tube."

96. For an *Improvement in Steam Boilers,* David Matthew, Philadelphia, Penna.

"This invention consists in certain improvements in the arranging of the combustion chamber and flue tubes."

Claim.—"The arrangement of the draft plates in relation to the inclined tubes or flues."

97. For an *Improvement in Sewing Machines;* Charles Moore, Buffalo, New York.

Claim.—"The specific mechanism for forming the loop, namely, the fork, crotch, lever, and stops, arranged and operating in combination."

98. For an *Improved Cushion for Wings of Bomb Lance;* Nathan Scholfield, Norwich, Connecticut.

Claim.—"The application of one or more springs as a medium for modifying the effects of percussion of a projectile when entering a case of guiding wings placed at the muzzle of a gun, to prevent the violent dynamical effect of a rigid and instantaneous concussion thereon by the projectile in its discharge."

99. For an *Improvement in Ploughs;* R. S. Stenton, City of New York.

Claim.—"Uniting two or more ploughs by an intermediate share, said share commencing at or near the point of the plough A, and extending backwards in the direction of the sole of the land-side of said plough, and receding obliquely at or about the angle of the share of said plough, until it meets the share of plough B."

100. For an *Improved Pocket-book Alarm;* Wm. Stoddard, Lowell, Massachusetts.

Claim.—"One or more hooks, or their equivalents. Also, the stand, or its equivalent, (carrying the hook,) relatively arranged with the spring to allow an elastic but limited movement of this stand for disengaging the alarm, if an extraction of the pocket-book should be attempted by a pick-pocket. Also, the thumb-piece and finger, or their equivalents, for setting or cocking the alarm."

101. For an *Improvement in Potato Planters;* Stephen H. Strong, Brunswick, Ohio.

Claim.—"The seeding wheel, armed with adjusting buckets and checks, in combination with the hopper and sliding bottom."

102. For an *Improved Shingle;* S. R. Tenney and Asa Bennett, Hubbardstown, Mass.

Claim.—"As a new article of manufacture, a carbonized shingle."

103. For an *Improvement in Reaping and Mowing Machines;* H. G. Vanderwerken, Greenbush, New York.

Claim.—"The combination of the stationary and bracing gear, with the auxiliary frame, driving-wheel, and pinions."

104. For an *Improvement in Construction of Salt Pans;* Wm. S. Worthington, Newtown, New York.

Claim.—"The employment, within a brine evaporating pan, of a grating or perforated false bottom."

105. For an *Improved Machine for Sticking Pins on Paper;* Thaddeus Fowler, Assignor to the American Pin Co., Waterbury, Connecticut.

Claim.—"The combination of the plate or form, with the slotted form. Also, the combination of the sliding frame with the slotted form."

106. For an *Improvement in Ice-breaking Boats;* James D. Foster, Cincinnati, and H. C. Foster, and John Q. Miller, Springfield, Ohio.

"This improvement consists in arranging the breaker bars with their bearings, for the purpose of removing them readily."

Claim.—"Making the breaking bars detachable."

107. For an *Improvement in Reaping and Mowing Machines;* J. W. Brokaw and Thomas Harding, Assignors to Warder, Brokaw & Child, Springfield, Ohio.

Claim.—"The peculiar method of regulating the height of the cut and relieving the draft on the joints of the tongue, by means of the bar, in combination with a tongue hinged to the finger bar or front of the main frame of the machine."

108. For an *Improvement in Sewing Machines;* W. C. Watson, Assignor to self and G. H. Wooster, City of New York.

Claim.—"1st, The employment of a stationary needle, combined in such manner with a reciprocating table or cloth holder, that the protrusion of the needle through the cloth or material being sewed, is caused by the movement of the said material. 2d, Operating the looper by attaching it to a lever which is carried by the reciprocating table or cloth holder, and which derives motion from the movement of the said table or cloth holder, through an off-set on one of its edges working in contact with the driving shaft, or its equivalent. 3d, The combination of the reciprocating table or cloth holder, the oscillating feed plate, the stationary bar, and the spring, the whole operating to produce the movement of the cloth in the direction to produce the same."

109. For an *Improvement in Steering Apparatus for Vessels;* Charles Weed, Assignor to self and Stephen B. Cram, Boston, Massachusetts.

Claim.—"Placing the parallel screws, one immediately over the other, and connecting them by the gears; the steering wheel being attached to one of the screws. Also, the stationary guide bar, as arranged with the grooved nuts and bearing block."

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110. For an *Improvement in Revolving Fire Arms;* Ethan Allen, Worcester, Mass.

Claim.—"The plate A."

111. For an *Improvement in Cut-off Valve Gear of Steam Engines;* Horatio Allen, City of New York.

Claim.—"The combination of a plunger operating to force a fluid through an orifice, or of the dash pot with secondary chamber, with the loose toe, whereby the fall of the toe, when tripped, is controlled."

112. For an *Improved Adjustable Gauge for Dove-tails;* Juan S. L. Babbs, Boston, Massachusetts, and Amos H. Ray, Providence, Rhode Island.

Claim.—"1st, The use of bar provided with two or more stationary or movable cutter heads, with knives or markers attached. 2d, The arrangement of the movable gauges."

113. For an *Improvement in Casters for Furniture;* Timothy Burger, Oyster Bay, New York.

Claim.—"The new manufacture of caster, to wit: a ball caster in which the large ball rolls against a small ball arranged above it, and against friction rollers, arranged below the horizontal centre of the large ball, so as to retain it (the large ball) in its place when the caster is lifted from the floor."

114 For an *Improvement in Cultivators;* David P. Daggett, Palmyra, New York.

Claim.—"The peculiar construction and arrangement of parts whereby the frame of the cultivator may be elevated or depressed in relation to the surface of the soil, either parallel to the plane of the surface, or inclined thereto forward or backward at any desired angle, by means of the lever beam, swivel wheel, swivel clevis, and adjustable wheels."

115. For an *Improvement in Billiard Table Cushions;* Levi Decker, Bergen, N. J.

"This invention consists in so constructing the cushions of billiard tables, as to prevent too much indentation therein by the ball, consequently diminish the tendency of the ball to jump over the sides, and at the same time retain sufficient elasticity for the return of the ball."

Claim.—"The combination of india rubber and steel spring for billiard table cushions."

116. For an *Improvement in Machinery for Lifting Water;* Isaac C. Foster, Union City, Tennessee.

Claim.—"The arrangement of the double pawl and of the lines, the sliding rings and knots, or their equivalents, in combination, so as to automatically shift said pawl alternately to opposite sides of the windlass, and thereby prevent such ascending bucket, in turn, from returning into the well."

117. For an *Improvement in Tubes for Seed Planters;* Joseph C. Haines, Dublin, Iowa.

Claim.—"In the combination with the tooth of a grain or seed drill, the 'tube' or grain duct, composed of a close coil of wire."

118. For an *Improvement in Corn and Cob Mill;* Harry Hall, Mansfield, Ohio.

Claim.—"The cone and meal trough cast in one piece, for the purpose of strengthening the cone, and giving a firm base for its attachment."

119. For an *Improvement in Mechanical Movement for Sewing and other Machines;* James Hanley, City of New York.

Claim.—"The roller moving in a conical recess, and brought into action both to hold

and release automatically by the friction of its surface contact with, and by the motion of, the machine."

120. For an *Improvement in Corn Planters;* J. J. S. Hassler, Ripley, Virginia.

"This invention consists in constructing what I have termed a perambulating equidistant planter."

Claim.—"The detachable sliding perforated gauge valve blocks, or seed escapes, with the alternately actuating and reacting pressure springs, the adjustable, graduating, tapering throat blocks, together and in combination with the hopper and striding equidistant legs and spouts."

121. For an *Improved Spring Valve Cock;* Moses C. Hawkins, J. W. Goodwin, and James Cummings, Erie, Pennsylvania.

Claim.—"The valve, valve gauge, with spiral spring, in combination with the ordinary air cock."

122. For an *Improvement in Dress of Mill Stones;* Nelson Hayward, Cleveland, Ohio.

Claim.—"Making the deep portion of the furrows sufficiently wide from the eye half-way to the periphery, or thereabouts, with a flat, or nearly flat bottom, parallel, or nearly parallel, to the face of the stone. Also, lands, whether used in combination with furrows having parallel bottoms, or otherwise."

123. For an *Improvement in Egg-Beaters;* John B. Heich, Cincinnati, Ohio.

Claim.—"The bar, elastic disk, and beater, in combination with the bow having lips, and vessel provided with lips."

124. For an *Improvement in Horse Rakes;* Valentine Hyatt, Westfield, Massachusetts.

Claim.—"1st, The combination of the lever, cross-bar, levers, and arms, for raising the rake from the ground when not in use. 2d, The combination of the lever, connecting rods, levers, and arms, for holding the rake whilst it is filling with hay, and for discharging the load."

125. For an *Improvement in Vault Light Covers;* George R. Jackson, City of New York.

Claim.—"The sky-light—the essential feature of novelty therein consisting in combining with a metallic frame, a series of glasses whose upper surfaces are flat, or nearly so, whilst the under surface of each glass is in the form of a concavity, whose sides are bounded by diagonally descending straight lines or planes."

126. For an *Improvement in Seeding Machines;* Charles C. James, Dayton, Ohio.

Claim.—"The employment of a stepped slide, having conveyers attached, the above parts being arranged and operating so as to thoroughly agitate the seed while in the hopper, and then to deliver it with a shaking hopper-like motion to the furrow tubes, thus preventing all liability in the grain to clog or bunch, and rendering the machine capable of sowing various kinds of seeds without change or alteration of said slides."

127. For an *Improvement in Seeding Machines;* Hiram Kellogg, McHenry, Illinois.

Claim.—"The construction of the double-pointed mattock-like revolving digging shovels, arranged together in pairs at right angles to each other, and having passing through their centres a shaft or axis, and in arrangement and operation with a revolving scatterer attached to an adjustable graduating framing, and in combination with an adjustable sliding hopper or seed fountain, through all of which devices—forming an individual or unity of machine—the soil is dug up, pulverized, and scattered, and the seed or grain is deposited and covered up to a greater or less depth in one operation of the machine."

128. For an *Improvement in Cotton and Hay Presses;* James Massey, Thomasville, Georgia.

Claim.—"The manner of constructing a portable press by means of the slotted crossties let into the posts and fastened by keys, thus forming a permanent self-supporting press, readily adjusting without the use of either bolts or screws to fasten it together."

129. For an *Improvement in Hubs of Carriage Wheels;* Cornelius Merry, City of New York.

"This invention consists in a peculiar construction of hub and axle, whereby the surfaces will be but small, and a corresponding diminution of friction attained."

Claim.—"The combination of boxes, wheels, securing plates, and wheels, with the small axle arm."

130. For an *Improvement in Seeding Machines;* Samuel Mills, New Castle, Ohio.

Claim.—"The rotating shaft provided with projections and placed within the seed boxes, which are provided with slides, in combination with the box having a perforated bottom, and provided with the endless cord operated by the cam and lever."

131. For a *Flexomanus;* Horace A. Nathans, Philadelphia, Pennsylvania.

Claim.—"The combination of a series of cranks and rings, together with the bar for supporting the wrist."

Note.—The above invention is for imparting flexibility to the muscles required in performing on the piano-forte.—*Clk.*

132. For an *Improved Portable Field Fence;* Thomas B. Page, Laurel, Ohio.

"This invention consists in a provision whereby the fence is adapted to stand vertically and firmly on unlevel ground."

Claim.—"The base or chair composed of two members, and in combination with the panels and link, or its equivalent."

133. For an *Improvement in Cooking Stoves;* Samuel Pierce, Troy, New York.

Claim.—"Equalizing the heat of an oven heated by a surrounding flue of hot air, by interposing between the fire chamber and that portion of the oven contiguous thereto, an air chamber or flue interior to the main flue, between said main or exterior flue and the oven, so as to shield that part of the oven from the intense heat of the exterior flue at that point, and thus equalize and diffuse the heat over the whole surface of the oven."

134. For an *Improved Portable Saw Mill;* T. T. Prosser, Oconomowock, Wisconsin.

"This invention consists in attaching circular saws to a movable frame passing along a slide operated by a band and pulley, for the purpose of obtaining a continuous succession of cuts to prevent stopping and reversing machinery, and avoid cutting both ways."

Claim.—"The peculiar method of operating circular saws, by means of a sliding frame attached to a movable chain or belt, in combination with the several parts described."

135. For an *Improvement in Surface Condensers;* Thomas Prosser, City of New York; patented in England October 31, 1854.

Claim.—"The application of condensers consisting of two hollow slabs connected together by concentric tubes, and communicating with each other, by means of the annular spaces formed by them, when, and at the same time, such condensers are combined with and placed in cisterns so as to form one complete condensing apparatus."

136. For an *Improvement in Cheese Presses;* C. H. Robertson, Middleport, New York.

Claim.—"The employment of the slotted box attached to the cross-piece, for the purpose of confining the levers, and allowing them to slip an end by means of the slots in said box, thus changing position and gaining the length of the slot in downward motion, in addition to the fixed distance of the lever, before a change of the nuts on the screw is necessary. Also, the combination of the cord, pulleys, levers, and slotted box, when arranged with the cross-piece, and screws, and nuts, for the purpose of making a cheese press."

137. For an *Improvement in Lubricating Oil Cups;* Enoch N. Roland, Baltimore, Maryland.

Claim.—"The peculiar combination of the screw valves with each other, and with the funnel neck and other portions of said oil cup."

138. For an *Improvement in Steam Cotton Press;* John Roy, New Orleans, La.

Claim.—"The employment or use of a plurality of steam cylinders of different di-

mensions, arranged and applied to the press so that the cylinders of small capacity may be first used, or used at the commencement of the stroke, and the larger one used near the completion of the stroke, whereby the steam is supplied in quantities commensurate with the power required at different parts of the stroke, and a saving of steam thereby effected. Also, connecting the piston with the cross-head, by means of the cylinder and hollow rod, arranged in connexion with the tank or cistern, and the loaded valve, with levers attached, whereby a compensating piston rod is obtained, the rod being allowed to contract as the cross-head descends, and expand as it ascends, and at the same time, when expanded or drawn out, being, in consequence of the hydraulic arrangement, perfectly rigid, so that the full effective force exerted against the piston will be communicated to the cross-head and follower."

139. For an *Improvement in Bracing Springs of Vehicles;* C. W. Saladee, Columbus, Ohio.

Claim.—"The combination of the central portions of the side springs with the hind axle, by means of the diagonal tension rods."

140. For an *Improvement in the Fuses of Shells and other Projectiles;* Nathan Schofield, Norwich, Connecticut.

Claim.—"1st, The application of a perforated conical protecting plug, penetrating the end of the fuse cord, and the connecting it thereto by some plastic and adhesive substance, and also inserting this with the fuse cord in place, in the conical cavity opening from the fuse to the vent chamber, for the purpose of securing more perfectly the ignition of the fuse, while the flame from the discharge of the gun is prevented from passing in outside of the fuse, or of forcing the fuse inward. 2d, Opening and expanding the end of the fuse cord, and applying it under the seat of a protecting plug, and causing the plug to be pressed firmly thereon, so as to secure it from being forced through the aperture by the discharge."

141. For an *Improvement in Winnowing Machines;* John Shipley, Princeton, Wis.

Claim.—"The combination of the levers with the shoe."

142. For an *Improvement in Feet Warmers;* H. G. Seekins, Sr., and H. G. Seekins, Jr., Elyria, Ohio.

Claim.—"Constructing the reservoir with a flanch, having perforations which shall correspond with perforations in the flanch."

143. For an *Improvement in Life Preservers;* James E. Serrell and Wm. Davis, City of New York.

Claim.—"The manner of forming floats for the pockets of life preserving jackets, by filling bladders with shavings, or equivalent material."

144. For an *Improvement in Pumps;* Harmon A. Shelden, Middlebury, Vermont.

Claim.—"The employment or use of the supplementary cylinder or air chamber, communicating with the pump cylinder by means of the pipe, and having the induction and force pipes attached, which are provided respectively with the valves."

145. For *Improved Supporting Reels for Harvesters;* Thomas I. Stealey, Middlebourne, Virginia.

Claim.—"The reel supported by hinged arms, in combination with the notched and adjustable braces, bar, and rake frame."

146. For an *Improved Boring Machine;* Lafayette Stevens, Elmira, New York.

Claim.—"The loose independent collar, provided with knife edges to keep it from turning, for the purpose of furnishing a bearing for the head of the auger while in operation. Also, the sharp annular spur, for the purpose of centreing and guiding the auger, and at the same time leaving a core of the material bored in the centre of the auger. Also, the oblique traversing rests, in combination with the screws and dogs, for the purpose of adjusting the timber to the auger, and holding it firmly while under the operation of the auger."

147. For an *Improved Infantine Exercising Chair;* John Sawin, D. J. Goodspeed, and John H. Minott, Gardner, Massachusetts.

Claim.—"Our improved child's exercising chair, as constructed with the continuous

or endless foot-rest, and with its seat supported by a spring or springs, and so as to be capable of being freely rotated."

148. For an *Improvement in Bagasse Furnaces;* Moses Thompson, City of New York.

Claim.—"1st, The combination of two chambers, the one above the other, and separated by a grate, the lower one for the combustion of any known dry carbonaceous fuel, and the upper one in immediate proximity therewith, to receive heat therefrom for heating and drying the charge of wet fuel, with a mixing chamber, into which both continuously and simultaneously discharge their gases before reaching the thing to be heated for mingling and mutual combustion. 2d, In combination with said fire chamber and wet fuel chamber or drying chamber, making the grate upon which the wet charge rests sufficiently open to allow the lower portion of the wet charge, as it becomes dried and charred, to fall through into the fire chamber, and keep a hot fire therein, supplying the place of other dry fuel, while the uncharred portion of the wet fuel is properly supported by the grate till dried. 3d, Placing the mixing chamber of combustion in substantially the same position relatively to the fire and the wet charge, so that the products of combustion from the dry fuel may pass along the lower part of the wet charge, drying and charring it on their way to the mixing chamber, and reach it without being in any considerable degree obstructed or cooled by the wet charge."

149. For an *Improvement in Steam Boilers;* F. R. Walker, Tulley, Missouri.

Claim.—"The arrangement of the vertical deflecting plates in relation to the water tubes, water spaces, and the furnace and uptake."

150. For an *Improvement in Bayonet Fastening;* James N. Ward, U. S. A., City of New York.

Claim.—"The method of securing the bayonet by means of the spring hinging or turning about some point on the bayonet or gun. Also, the right to attach the spring in such manner to the barrel or bayonet, as shall prevent its turning farther than necessary, and to use any mechanical contrivance, such as studs, &c., to effect the same object."

151. For an *Improved Drawing Knife;* Richard N. Watrous, Charlestown, Ohio.

Claim.—"Attaching the handle to the knife, whereby the relative position of the blade and handles may be varied, as occasion may require, or the nature of the work may demand."

152. For an *Improvement in Curtain Fixtures;* Lewis Whitehead, Buffalo, N. York.

"This invention consists in a mechanical arrangement, whereby I am enabled to lower the curtain from the top and raise it from the bottom, for the purpose of regulating ventilation or light."

Claim.—"1st, The rail, in combination with the sliding block and the brace. 2d, The friction roller, in combination with its movable bearing, the rail, and the projecting shoulder, for operating the curtain. 3d, The sliding wedge bolt, in combination with the movable bearing, or the eccentric, as an equivalent. 4th, The extension bar with the roller bearing and set."

153. For an *Improvement in Machines for Pegging Boots and Shoes;* Wm. Wells, Assignor to Edgar M. Stevens, Boston, Massachusetts.

Claim.—"The combination of the pegging mechanism, viz: the awl, peg-driver, knife, and peg-carrier, with a head."

154. For an *Improvement in Sewing Machines;* Henry Behn, Assignor to self and Thomas Sewell, City of New York.

Claim.—"The combination of the needle, thread-carrier, and shuttle. Also, the method of operating the needle, by means of the bent arm on the vibrating shaft, actuating the slide to which the needle is affixed."

155. For an *Improvement in Seeding Machines;* John Critcherson, Assignor to John Warren, Boston, Massachusetts.

Claim.—"1st, The use of fluted conical valves, vibrating for the purpose of agitating the seed. 2d, The device for simultaneously raising or depressing said valves, in order to regulate the amount of seed discharged, and also for stopping the flow of seed, said

devices consisting substantially of the slat (the lower side of whose extremities are wedge-shaped), said slat being moved by the lever, and held in place by the set-screw, and the reciprocating slat *n n*, resting on *p p*, and furnished with holes for receiving and vibrating the adjustable pins which support the valves."

156. For an *Improvement in Snow Ploughs;* Newcomb Demary, Attica, New York, Assignor to James Yates, Philadelphia, Pennsylvania.

Claim.—"The combination of the mould-board, and of the inclined plane elevator, open at the sides, and so arranged as to elevate the snow from the track, about to the level of the top of the surrounding snow, before it is pressed laterally by the mould-boards. Also, the side cutters, arranged so as not to project in front of the elevator, or to obstruct the lateral escape of the snow at the side of the elevator."

157. For an *Improvement in Locomotive Furnaces;* George S. Griggs, Roxbury, Assignor to self and Wm. A. Bullard, Dedham, Massachusetts.

Claim.—"The arrangement of a fire-brick arch or shelf attached to the rear of the furnace, and extending horizontally, or nearly so, beneath and in front of the tube sheet, and over the fire towards the fire door, in such a manner as to form a combustion chamber immediately in front of the tube sheet, in which the smoke and gases, after passing over the heated surface of the bridge, are consumed."

158. For an *Improvement in Journal Boxes of Railroad Cars;* Robert McWilliams, Assignor to self and Adam J. Frederick, Philadelphia, Pennsylvania.

Claim.—"The combination of the lower or oil chamber of the box, with the inclined tapering grooves in the outsides thereof, on a line above the lower line of the journal, so that the latter may be easily and quickly exposed for filling, at the same time giving easy access to the packing."

159. For an *Improvement in Grate Dampers;* John O'Brien, Assignor to Owen Collins and John Dunley, City of New York.

Claim.—"The employment within a fire place of a damper, composed of two frames, when one of said frames is hinged to the other frame."

160. For an *Improvement in Ventilating Mattresses;* Thomas Tolman, West Townsend, Assignor to John P. Sabem, Fitchburgh, Massachusetts.

Claim.—"The valve and bed, so constructed and relatively arranged in connexion with each other, that the induction and expulsion of air through the bed to ventilate it, results from the movement of the bed caused by its use."

161. For an *Improvement in Straw Cutters;* Moses Clements, deceased, Worcester, Massachusetts; patent issued to Wm. T. Clements, Buckland, Massachusetts, administrator of the estate of said Moses Clements, deceased.

Claim.—"The combination of the revolving knife or knives, and the stationary adjustable knife and crowning bed-piece with feed rolls."

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162. For an *Improvement in Machines for Preparing Fibrous Substances for Spinning;* James Aperly and Wm. Clissold, Dudbridge, England; patented in England, December 4, 1856.

"This invention relates to a novel mode of delivering the sliver from one preparing machine to another, and so making the preparation process continuous, while at the same time the uniformity of the prepared sliver is insured."

Claim.—"The means herein described for conducting the roping or sliver from one preparing machine to the other, and laying the roping or sliver in parallel lines on the feed bands, aprons, or tables of preparing machines."

163. For an *Improved Washing Machine;* Henry L. Bridwell, New Albany, Indiana.

Claim.—"The combination of the corrugated cylinder, with the single oscillating self-adjusting knuckle."

164. For an *Improvement in Clocks;* Robert P. Cunningham, Eastford, Conn.

Claim.—"1st, Looped or slotted spring pallets acting tensively from the faces of the

swing wheel teeth. 2d, The combination of the tensive pallets and swing wheel teeth, either with or without the stops, or with the stops."

165. For an *Improvement in Extension Tables;* Edwin A. Curley, Westport, Conn.

Claim.—"Constructing the slides of sheet metal, corrugated and bent by any proper means, so as to form tubes provided with longitudinal dove-tailed tongues, and grooved, by which the tubes are connected and allowed to slide longitudinally."

166. For an *Improved Nut Machine;* J. C. Day, Jersey City, New Jersey.

Claim.—"The arrangement and use of the cutting die, the compressing dies, the punches, and the finishing and discharging die. Also, the arrangement of the projecting under side or bottom of the die-box, in combination with the feeding standard, shear edged die-top, and dies, in such a manner that the nut-bar is fed into the machine, the nuts cut therefrom and finally discharged from the machine, without the employment of any other means except the ordinary or otherwise necessary motions of the two dies. Also, the arrangement of the bearing with sliding wedges, which are adjusted by screws, or their equivalents, for the purpose of accurately adjusting the movements of the toggle levers and links. Also, the arrangement and combination of the sectors and cam."

167. For an *Improved Machine for Turning the Band-portions of Carriage Hubs;* Zéna Doolittle, Perry, Georgia.

Claim.—"The exclusive use and combination of the strap wrench, the handle, and the sliding rest, with the cutter."

168. For an *Improvement in Shovel Ploughs;* David Eberly, Waynesville, Ohio.

"This invention consists in a peculiar arrangement of means for adjusting the shares, whereby the same may be placed more or less angularly or obliquely with the ground, so that they may enter the same at a greater or less depth, and also placed so as to throw the soil towards or from the rows."

Claim.—"Securing the shares to the beam by having the upper ends of their bars fitted in the bars, the bars also passing through the loops or eyes of the bars, and secured therein by keys, the bars being secured to the beam."

169. For an *Improvement in Wine and Cider Press;* John Eiberweiser, Cincinnati, Ohio.

Claim.—"The peculiar construction and arrangement of the platform, and the double box, on a wine and cider press."

170. For an *Improvement in Casting Hinges;* Nicholas A. Fenner, Providence, Rhode Island.

Claim.—"The employment of a separate pin for each core, when the cores are moulded upon the pins, and the latter inclosed within the hinge by the casting."

171. For an *Arrangement of Air Tubes in Fire-boxes of Steam Boilers;* Benjamin L. Griffith, Hazleton, Pennsylvania.

Claim.—"The placing of air tubes within the water tables or series of water tubes."

172. For an *Improved Washing Machine;* George Hall and John Fordyce, Morgantown, Virginia.

"This invention consists in the peculiar combination of devices, by which we cause the clothes to turn over, and change positions, at each operation of the rubber or dash block or board."

Claim.—"In combination with the rubber, the apron attached to the spring at one of its ends, and to said rubber by its other end, and passing underneath the roller for the purpose of turning the clothes over and over at each operation of the rubber."

173. For an *Improvement in Potato Diggers;* Jacob E. Hardenbergh, Fultonville, New York.

"This invention consists in the combination of an adjustable share and grating, and horizontal revolving arms, attached to a suitable framing mounted on wheels."

Claim.—"The combination of the share, grating, rotating arms, arranged as shown, or in an equivalent way."

174. For an *Improvement in Cultivators;* A. W. Hawley, Milan, Ohio.

Claim.—"The movable fender, adjustable arm, and movable brace, with the peculiar

shaped share, for the purpose of protecting the plant from injury, and for changing the share and fender to the right or left of the same."

175. For an *Improved Mode of Treating Photographs and other Pictures;* Ezekiel Z. Hawkins, Cincinnati, Ohio.

Claim.—"Giving the front surface of the glass tablet which has an image or picture finished on its back surface, a semi-opaque and granular appearance, and consequently producing an atmospheric relief and additional painting surface, by the application of varnish, wax, or other similar substance, to the front surface of the glass tablet."

176. For an *Improvement in Bedstead Slats;* Samuel Hickok, Buffalo, New York.

Claim.—"Two lath placed parallel with each other, and one above each other, and connected or fastened together at or near the centre, constructed and used with or without the spiral springs."

177. For an *Improvement in Railroad Snow Plough;* Andrew Hotchkiss, Sharon Valley, Connecticut.

"This invention consists in a novel construction of the plough, whereby the same may be used both in light and deep snows, and be made to operate effectually in either case, and also used as an excavator in deep drifts."

Claim.—"The employment of a plunger, composed substantially of a frame and share, which is moved back out of the way when the machine is driven into the snow to receive a load, but which may be pushed forward to force out the snow when unloading; thus constituting a snow plough and excavator capable of being directly loaded and unloaded by the force of the locomotive. Also, the combination of the cutting frame, so that after the machine has been run into the drift and filled, the cutting frame may be swung over in front and made to cut down through the snow, thus completely detaching that portion contained in the machine from the main body of the drift."

178. For an *Improvement in Sewing Machines;* George W. Hubbard, West Meriden, Connecticut.

Claim.—"The forked needle, to enchain the loops on the opposite side of the cloth, or other material, to that on which it enters."

179. For an *Improvement in Machine for Cutting and Grinding Corn Stalks;* Wm. G. Hugett, Williamsburgh, Pennsylvania.

Claim.—"Combining an inclined grinding concave with a cutting wheel and disk."

180. For an *Improved Machine for Rolling Cornice;* Asa Johnson, Cairo, New York.

Claim.—"The arrangement of the series of rollers, guides, and rollers, and die, for the purpose of forming the sheet metal into cornice and gutters for buildings while hot, and passing it through the machine in boiling oil."

181. For an *Improved Hand Printing Press;* J. M. Jones, Palmyra, New York.

Claim.—"1st, The arrangement of the various parts, so that the lever can be operated at right angles to the curved bar and inking bar, suspended on the shaft. 2d, Suspending the bed on the lever bar."

182. For an *Improved Dynamometer;* George Juengst, City of New York.

Claim.—"The connexion of the loose pulley with belt, the support with the spring, sliding frame with ring, and the connexion of said ring with disk, by lever and nipping pawl, and with a counting apparatus, by which arrangement the amount of working power is registered for the whole time of its action."

183. For an *Improved Screw Cutting Machine;* Wm. Kenyon, Steubenville, Ohio.

Claim.—"1st, The combination of the dies which have an angular cutting extension or shoulder on their front face, with the eye screw bolts, and a chuck which has straight radial grooves in its face. 2d, Providing the peculiar oil reservoirs in the front of the chuck, between the cutting dies. 3d, The face plate, consisting of a short hollow cylinder with openings in its periphery."

184. For an *Improvement in Refining Iron;* Wm. Kelly, Lyron Co., Kentucky.

"This invention consists in certain improvements in the method of refining iron in the hearth of the blast furnace, and in the use of an additional refining chamber."

Claim.—"Conducting the blast down through the liquid iron to near the bottom of

the hearth, by the tuyer pipe. Also, refining and decarbonizing crude iron simultaneously in the hearth of a blast furnace, and in an adjoining chamber having communication therewith, when the blast enters directly into but one of either of the chambers."

185. For an *Improvement in Glass Knobs for Doors;* Charles D. Kellogg and Wm. L. Coan, Boston, Massachusetts.

Claim.—"Arranging on the bottom of the cavity a plate or disk of foil, in combination with arranging an annulus of foil around the mouth of the cavity, and against the glass knob."

186. For an *Improved Hydraulic Valve;* Alonzo R. Ketcham, Buffalo, New York.

Claim.—"The arrangement of the chamber on the pipe or cylinder, for the purpose of protecting the sector and valve, and to allow of a proper movement thereof, the same being operated by the screw (or equivalent)."

187. For an *Improvement in Cotton Seed Planters;* Lorenzo D. Law, Henderson, Georgia.

"My invention is an improvement in machines for planting cotton seeds."

Claim.—"The employment of the vibrating agitators, each having their radiating arms arranged with respect to each other, in combination with the longitudinal slots, at right angles to the axis of the radiators."

188. For an *Improved Furnace for Tempering Scythes;* John E. Layton, Pittsburgh, Pennsylvania.

Claim.—"1st, Constructing the top of a furnace in such a manner that the same, or a portion of the same, is curved or shaped so as to conform with the curve or shape of the edge of the article to be hardened, and providing in the top (thus shaped) an opening, or a number of such openings. 2d, Providing in the top of the said furnace, an opening (or a number of such openings,) of such a shape as to conform with the curve or shape of the article to be tempered. 3d, Providing on the top plate of the said furnace two blocks with the openings."

189. For an *Improvement in Sewing Machines;* Wm. H. Lazelle, City of New York.

Claim.—"The addition to, or conjunction with, the revolving hook, of the point or piece (attached to the feeder,) which meets the point of the hook after it has caught the loop, and prevents the loop which is formed from interfering with the next loop, or from being lost."

190. For an *Improvement in Pumps;* Hosea Lindsley, Ashville, North Carolina.

Claim.—"The attaching of the axis of the pump cylinder eccentrically to a stationary circle plate, in combination with the attaching of the pistons of said cylinder to said circle plate, by means of a loose ring or collar, connecting rod or strap, and sliding frame."

191. For an *Improved Machine for Carving Wood;* Isaac Lindsley, Providence, Rhode Island.

Claim.—"1st, The use in carving machines of the lift and fall motion of the tracer, for the purpose of enabling the same to trace out any design, however sharp or difficult the same may be. 2d, The bar lever and cord, in combination with the cross-bar."

192. For an *Improved Implement for Cutting Metal Tubes;* Thomas J. Lloyd, Pottsville, Pennsylvania.

Claim.—"The collar, having the stock fitted loosely thereon, and screwed in proper position by the flanch and ring, the stock having a socket attached in which a cutter and screw are fitted."

193. For an *Improvement in Feed-water Attachments to Steam Engines;* Lewis Martin, City of New York.

Claim.—"The arrangement of the oscillating cylinders and plunger within a wheel, whereby the plungers, when moving outwards, are subjected to the full boiler pressure in every direction, or held in perfect equilibrium."

194. For an *Improvement in Artificial Fuel;* Eugene Miannay, City of New York.

Claim.—"The composition of a new coal or artificial fuel, by the several ingredients mixed together in different proportions, called ligno-bituminous coal."

195. For an *Improved Saw-set;* Edward Marshall, Brooklyn, New York.

Claim.—"A saw-set."

196. For an *Improvement in Corn Huskers;* David M. Mefford, Perrysburgh, Ohio.

Claim.—"1st, The feed drum provided with ear pockets, when used in combination with the knife and husking peg. 2d. The husking rollers, in combination with the hinged and roughened apron."

197. For an *Improvement in Grinding Mill;* John R. Morrison, East Springfield, Ohio.

"This invention consists in the arrangement and dress of the stones, together with certain devices for regulating them and feeding the grain to them."

Claim.—"1st, Hanging the bed-stones on cleats or pins, and operating said stones by means of said pins, in slots or grooves in the frame, for the purpose of adjusting the stones. 2d, The combination and arrangement of the lever, screw, and sleeve, with the stone. 3d, The arrangement of the runner between two bed-stones, when said runner has a flouring dress on one side, a chop dress on the other, for the purpose of grinding different kinds of grain and feed at the same time."

198. For an *Improvement in Casting Car Wheels;* A. A. Needham, Rockford, Ill.

Claim.—"Casting the wheel from the different kinds of iron, hard and soft, the hard iron to form the tread, and the soft to form the hub and centre of the wheel, and properly disposing the two kinds of iron within the mould, by giving the same a rotating motion."

199. For an *Improvement in giving Motion to Valves of Steam Engines;* Horatio O. Perry, Buffalo, New York.

"My invention consists in simply shutting the valve by a force perpendicularly applied in its more approved form; the force is also made to vary with the necessities of the case, and in its most perfected form; it is also applied in such a direction that the valve is partially balanced thereby."

Claim.—"1st, The above described method of shutting a rolling or partially rotating valve, by putting on a link so attached that its effect in rotating the valve decreases as the valve assumes its most desirable shut position, and tends to revolve it in the reverse direction, when the valve revolves by momentum past such position. 2d, The above described method of operating said link by the pressure of the steam, so that the whole amount of power available in shutting shall be always proportional, or very nearly proportional, to the resistance, for the purpose of enabling the valve to stop in the proper position under all pressures of steam."

200. For an *Improvement in Governors for Machinery;* George M. Phelps, Troy, New York.

Claim.—"Causing the centrifugal governor, or its equivalent, to regulate the rotary motion of a shaft with which the governor is positively driven, by making the governor control, by means of a valve, the motive action of a current of air, or other gaseous fluid, upon a piston or an analogous device, arranged to work the mechanical contrivance by which the speed of the said shaft to be regulated is immediately changed."

201. For an *Improvement in Cultivators;* John Righter, Clarksburgh, Virginia.

Claim.—"The employment of the pinions, when in combination with the screw-shaft and teeth or ploughs."

202. For an *Improvement in Vegetable Cutters;* Wm. Robinson, Highgate, Vermont.

Claim.—"The employment of hooked cutters running at different velocities on parallel cylinders."

203. For an *Improvement in Clothes Racks;* S. I. Russell, Chicago, Illinois.

"This invention has for its object the ready adjustment of the rotating frame, so that the clothes may be placed upon, and removed from, the frame with the greatest facility, and the working parts of the device rendered extremely durable."

Claim.—"The arrangement within the hollow base of a counterpoising weight, connected by a cord with the rising and falling rod, for the purpose of balancing, or nearly balancing, the hub and arms, and thus preventing the sudden fall and breakage of the parts, as well as rendering them easy of operation. Also, the employment of a spring attached to the base, and acting against the shaft."

204. For an *Improved Apparatus for Illustrating Conic Sections and the Lines of the Globe;* Forrest Shepherd, New Haven, Connecticut.

Claim.—"The combination of the globe with an extended horizon or surface, as the base or convex surface of the cone, or any other extended surface, on which may be written any geographical or other exercise with the globe, and be easily wiped or rubbed off. Also, the combination of the globe with the cone, when the cone is made in three or more segments, and the upper segment so cut as to illustrate the conic sections."

205. For an *Improved Approach-opening Farm Gate;* C. M. Smart, Watertown, New York.

Claim.—"The combination of the slide bolt and spring, so that by the withdrawal of a slide bolt, the spring will be wound up or contracted, and have sufficient strength to throw open and close the gate by the time the bolt is fully withdrawn, and the gate released."

206. For an *Improved Arrangement of Oscillating Engines and Pumps;* Gambrill Sprenkel and Thomas W. Basford, Harrisonburgh, Virginia.

Claim.—"The arrangement of the pump in such relation to the main cylinder and crank of an engine, that its pistons and valves shall be operated simultaneously with the piston and valves of the cylinder, and by the same means that actuates them. Also, the peculiar arrangement, consisting of boxes with inlet and outlet passages, hollow trunion with two chambers formed by diagonal partition, and with two sets of ports."

207. For an *Improved Portable Field Fence;* H. F. Manard, Wayne, Michigan.

Claim.—"Attaching or securing the fence to the ground, by means of the inclined bars or braces, attached to the posts and connected by cross-ties, in connexion with the stake provided with mortises and the wedges."

208. For an *Improved Machine for Turning the Leaves of Books;* Frederick Suter, Brooklyn, New York.

Claim.—"1st, The arrangement of the lever with the described mechanism, for the purpose of taking hold of the music leaf, turning the same over, and afterwards letting said leaf loose again, and dropping down so as to pass under the same. 2d, The fingers."

209. For an *Improved Churn;* Wm. H. Truesdell, Elgin, Illinois.

Claim.—"The employment of the peculiarly formed dashers having air tubes attached, said dashers being so made as to churn and introduce the air when turned in one direction, and presenting chambers for the collection of the butter when the direction is reversed."

210. For an *Improved Churn;* James Vandolah and Elias Curry, Dillsborough, Ind.

Claim.—"The construction of the dasher with the rim, wings, peripheral strips, horizontal plates. Also, the arrangement of the ribs with retaining hoops, so as to render them adjustable and removable."

211. For an *Improvement in Cultivators;* Lorin Wetherill, Worcester, Massachusetts.

Claim.—"In combination with a plough, the pair of revolving hoes or scrapers, having a vertical adjustment in addition to the adjustment of the edges thereof, so that the capacity of the machine may be increased with the increasing height of the plants to be cultivated by it."

212. For an *Improvement in Harvesters;* Wm. Webber, Jr., and John Webber, Rockton, Illinois.

Claim.—"Communicating motion from the main shaft of the driving-wheel to the cutter blade, by means of the intermediate shafts, arranged parallel with each other on opposite sides of the bearing wheel, in such manner that pulleys on the after ends of said shafts may be banded to each other, and a regulating fly-wheel be combined with the shaft."

213. For an *Improved Machine for Bending Horse Shoes;* Elbridge Wheeler, Marlboro', Massachusetts.

Claim.—"The machine for bending horse shoes, consisting essentially of the follow-

ing elements in combination, or their substantial equivalents, the traveling carriage, the bending levers, and the regulating cam."

214. For an *Improvement in Mode of Belting;* Benjamin Chester, City of New York, Assignor to W. H. Burnap, Lowell, Massachusetts."

Claim.—"The arrangement and combination of a pulley with the pulleys, when the driving belt, after passing round the small pulley, is led therefrom to and around the pulley."

215. For an *Improved Method of Governing the Cut of Circular Sawing Machinery;* A. C. Martin and M. M. Wormbaugh, Assignors to A. C. Martin and R. Ashcraft, Cincinnati, Ohio.

Claim.—"The mandrel, when working in governable circular joint swivel boxes, in combination with angular guide and lever. Also, the side end or lateral swinging movement of plummer blocks."

216. For an *Improved Cross-cut Sawing Machine;* George R. Moore, Assignor to self and Charles G. Sargent, Westford, Massachusetts.

Claim.—"1st, The peculiar method of hanging the inverted saw within its gate, by means of the guide wheel and block. 2d, Depressing the middle section of the horse. 3d, Driving the saw by means of the segment and straps. 4th, Uniting the ratchet wheel to its shaft by means of a friction clutch."

217. For an *Improved Method for Cutting the Zig-zag Grooves in the Stiles of Washboards;* O. L. Reynolds, Assignor to Hiram F. Snow, Dover, New Hampshire.

Claim.—"The method of cutting or forming the grooves in the stiles or side pieces of wash-boards, in which corrugated metallic rubbing surfaces are employed."

218. For an *Improvement in Casting Gas Retorts;* Abiel Pevey, Buffalo, New York.

Claim.—"The flask, composed of the several parts and former, constructed and relatively arranged and operated for moulding the retort, and for self-centralizing and setting the core."

219. For an *Improved Mode of Lighting Gas by Electricity;* Samuel Gardner, Jr., City of New York.

Claim.—"Turning on or shutting off inflammable gas by degrees, or gradually, through the agency of electricity."

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220. For an *Improvement in Straw Cutters;* Wm. Barrett, Stephentown, New York.

Claim.—"The combination of gauge and its handle, with the bar, and link, and spring, by means of which an oblique drawing as well as downward movement is given to the knife."

221. For an *Improvement in Hand Stamps;* E. E. Barrett, Salem, Massachusetts.

Claim.—"So arranging and constructing the ink fountain, that when combined with the inking roller of a hand stamp press, it shall serve the double purpose of inking the roller and distributing the ink over its surface."

222. For an *Improved Gearing for Feed Rollers in Re-sawing Machines;* D. B. Bartholomew, Lancaster, Pennsylvania.

Claim.—"The arrangement of a screw-shaft transversely and at right angles to the vertical adjustable feed rollers, when combined with the gearing by means of a screw pinion."

223. For an *Improvement in Oil Cans;* J. F. Bérendorf, Paris, France; patented in France, May 21, 1856.

Claim.—"The construction of oil cans provided with an internal cylinder, and piston, and a spring."

224. For an *Improvement in Springs for Railroad Cars;* John C. Blair, Pittsburgh, Pennsylvania.

Claim.—"A spring composed of a series of leaves or plates, so bent or curved as that

when piled one upon the other, the highest and lowest points of one leaf shall be in contact with the lowest and highest points, respectively, of the next adjacent leaf or plate, and so on throughout the series."

225. For an *Improvement in Furnaces;* Benjamin F. Blood, Port Jackson, N. York.

Claim.—"1st, A scuttle, in combination with the flues of the boiler, as a protection, a guide, and a re-heater for the gases passing through the flues, whether the said scuttle be made plain or indented, and whether it pass directly downward to the grate, or traverse some other portion of the inside surface of the fire-box. 2d, A downward bifurcated continuation of the smoke-stack, without any egress from the smoke-box between this continuation and the base of the stack, and extending downward as far as may be without disturbing those heavier sparks which may have fallen to the bottom of the smoke-box, into which bifurcations the exhaust pipes turn upward, the whole being designed by closing egress for the smoke at the top, to give the sparks an opportunity to settle in the smoke-box, or be returned to the fire through the nozzle, also to restrain the hot air and gas from immediately leaving the smoke-box at the top, at the same time that the legs will select the matter of their draft from the cooler and lower, instead of the lighter and hotter gases of the tops of the smoke-box."

226. For an *Improved Method of Connecting the Panels of Portable Field Fences;* John H. Bruen, Elmira, New York.

Claim.—"The button, in combination with the other devices for locking and securing the panels of field fences."

227. For an *Arrangement of Deflecting Plates and Spark Receiver in Locomotives;* Wm. H. Bullock, Boston, Massachusetts.

Claim.—"The reservoir in connexion with the elongated blast pipe."

228. For an *Improvement in Potato Diggers;* Isaac S. Brunnell, Montrose, Penna.

Claim.—"The arrangement, relatively to each other and for united operation, of the oblique hinged wings, diagonal pivoted adjustable racks, pivoted adjustable rods, and double mould-board ploughshare."

229. For an *Improvement in Lifting Jacks;* John Callaghan, Stroud Glades, Va.

Claim.—"The construction of a lifting jack, provided with series of perforations, and movable alternating fulcrums, the double notched lever combined with the chain and stay-pole."

230. For an *Improved Washing Machine;* Thomas C. Churchman, Sacramento, Cal.

Claim.—"The construction of a washing machine combining a horizontal and perpendicular motion produced on the wash boards, by the turning of the crank and shaft, and the running of the wheels in curved tracks."

231. For an *Improved Clamp for Setting Saws;* E. E. Cook, Cambridge, Ohio.

Claim.—"The two V shaped frames, connected at one end by a hinge, or its equivalent, and provided with the bars or stops, the frames being brought together by the screws and nuts."

232. For an *Improvement in Instruments for Drafting Coats;* Simeon Corley, Lexington, South Carolina.

Claim.—"The triangle, having an arm combined with the hoop or ring."

233. For an *Improvement in Seeding Machines;* Wm. Coggeshall, Masillon, and B. B. Warner, Wadsworth, Ohio.

"This invention consists in such an arrangement that the seeds can be equally distributed along the drill, and also that two kinds of seed can be sown at the same time, or separately and uniformly."

Claim.—"The levers, respectively bearing the removable and replaceable gear-wheel, when arranged, operated, and combined together, and in combination with the gear-wheels of the seed rollers and the driving wheel."

234. For an *Improved Machine for Sawing Hand Rails or Stair Wreaths;* John Davis, Cincinnati, Ohio.

Claim.—"1st, Providing what is technically known as spring in the rail, by present-

ing the sides of the plank (that is to say, the cutting planes of the warped surface,) acutely or obtusely to the plane of adjustment of the clamp stock, or their equivalent. 2d, The construction and arrangement of the hinged jaws, and their accessories, operating in combination with the adjustable clamp."

235. For an *Improvement in Railroad Car or Carriage Springs;* George Douglass, Scranton, Pennsylvania.

Claim.—"As a new article of manufacture, a carriage spring."

236. For an *Improvement in Burglar-proof Safes;* Leopold Eidlitz, City of New York.

Claim.—"Forming an improved burglar-proof plate, (or its equivalent,) by the union of an outwardly chill hardened layer of molten iron, with the ribbed surface of a zig-zag sheet of iron."

237. For an *Improved Device for Attaching Lightning Rods;* J. B. Elliott, Philadelphia, Pennsylvania.

Claim.—"Connecting the conductor to the building, by means of the wires bent, and secured in the head of the spike or nail."

238. For an *Improvement in Dry Sand Cores;* Wm. Gage and Richard B. Felthousen, Buffalo, New York.

"This invention relates to the preparation of flour by boiling or cooking the same, until it is changed into a starchy or viscous body, preparatory to its use in the composition of dry sand cores."

Claim.—"The application and use of the viscous substance (or paste,) which we obtain from flour in admixture with sand, for the purpose of forming dry sand cores."

239. For an *Improved Wash-Board;* Wm. M. Galusha and B. W. Safford, Arlington, Vermont.

Claim.—"Corrugating the sheet metal plate."

NOTE.—The above invention consists in the peculiar form of corrugations."

240. For an *Improvement in Locomotive Engine Wheels;* George S. Griggs, Roxbury, Massachusetts.

Claim.—"Confining the blocks of wood upon their sides, for the purpose of preventing them from being forced out and destroyed."

NOTE.—The above invention is for introducing wood between the rim and tire of locomotive and other railroad wheels.

241. For an *Improvement in Machines for Sawing Shingles;* George Hall, Morgantown, Virginia.

Claim.—"In combination with the horizontally reciprocating carriage for carrying the bolt to the saw, the transverse carriage also moving on horizontal ways, but provided with ribs so arranged as that the block or bolt dropping upon them shall be held in the proper position for alternately changing the point and butt of the shingle, and for giving the shingle the proper thickness and taper."

242. For an *Improved Spring Bottom for Bedsteads;* Royal Hatch, Strafford, Vt.

Claim.—"Stretching the sacking bottom upon springs."

243. For an *Improvement in Mooring Vessels;* Armigel W. Handcock, Allegan Co., Michigan.

Claim.—"Mooring a vessel during foul weather, by means of two hausers payed out at the usual bow hauser hole, and at the hauser hole which I especially construct abaft the fore chains, whereby a bow anchor and a waist anchor are arranged and operated."

244. For an *Improved Tool for Turning Journals;* James Hall, New Haven, Conn.

Claim.—"The combination of the divided hollow cylindrical cutter-box, furnished with ratchet teeth on its exterior and tightening screws, and the divided ring, handle, pawls, and fastening screw."

245. For an *Improvement in Blacksmiths' Tongs;* Wm. Hart, Mayville, Wisconsin.

Claim.—"Constructing the tongs with revolving jaws placed or fitted in the shanks."

246. For an *Improvement in Water Closets;* James T. Henry and Wm. P. Campbell, Philadelphia, Pennsylvania.

"Our invention consists in so combining the basin of a water closet with a valved chamber, cistern, and communicating pipes, that the soil may be readily and effectually disposed of, and all offensive smells obviated."

Claim.—"The chamber with its valve, in combination with the pipe of the basin, the cistern, and communicating pipe."

247. For an *Improvement in Balances for Detecting Counterfeit Money;* Ferdinand J. Herpers, Newark, New Jersey.

Claim.—"As a new article of manufacture, a coin balance."

248. For an *Improved Guide Gauge for Sawing Timber;* Jacob Hoke, Grand Detour, Illinois.

"This invention consists in the employment or use of two squares properly graduated, each arm being provided with a graduated slide, and the parts so arranged that the log or stick of timber may be marked at once at four sides, if necessary or desired, and without adjusting the squares after being properly fitted to the stick or log."

Claim.—"The graduated squares, provided with slides also graduated."

249. For an *Improvement in Mowing Machines;* Silas E. and Morgan P. Jackson, Booneville, New York.

Claim.—"Counteracting the side draft of a harvesting machine, by attaching the power that draws it to the uncontrolled end of a chain, the other end of said chain being attached to the lower end of a stud or bar."

250. For an *Improvement in Mowing Machines;* Silas E. and Morgan P. Jackson, Booneville, New York.

Claim.—"The combination in harvesting machines, having but one main supporting wheel, the finger bar resting on the ground, and supported by braces connected with it and the main frame of the machine, of the hinged lever and hinged axle, with its wheel, when arranged and located in relation to the rear cross-piece of the machine and the driver's seat."

251. For an *Improved Device for throwing into, and out of, Gear, the Tool of Mortising Machines;* Levi Kittinger, East Greenville, Ohio.

Claim.—"Operating or adjusting the two parts by the nut, by means of the oblique bars connected with the parts, and used in connexion with the catch."

252. For an *Improvement in Seeding Machines;* James Lawson, Lawrence, Mass.

Claim.—"Operating the marking device formed of the bars and the slides, by means of the cams with pins attached, when said cams are placed on the hollow shaft which encompasses the axle, and is connected therewith by means of the nuts fitted on the slotted ends of shaft, whereby the dropping and marking devices may be regulated as desired."

253. For an *Improvement in Hoes;* Horace A. Lothrop, Sharon, Massachusetts.

Claim.—"A new manufacture of hoe, or one having its blade composed of two or more separate isosceles triangular plates or teeth, each being lapped on or connected to, that next to it at their two corners, and each being supported by a separate prong of a furcated shank."

254. For an *Improvement in Preparing Plastic Cotton for Moulding Purposes;* J. M. Legare, Aiken, South Carolina.

Claim.—"The process for rendering cotton and other fibrous materials, including lignines of all kinds, plastic and capable of being worked by hand, or applied to roofing and other kindred uses."

255. For an *Improvement in Harvesters;* John Long, Masillon, Ohio.

Claim.—"Giving the cutter bar the vibrating motion by two complex spur-wheels, in combination with the reciprocating and rotating shaft."

256. For an *Improvement in Seed Drills;* Jacob Mumma, Harrisburgh, Pennsylvania.

Claim.—"The combination of the broad casting apparatus for sowing pulverized manures with the seed drills, when the former is placed in advance of the latter."

257. For an *Improvement in Track Clearers for Mowing Machines;* Abraham Marcellus, Amsterdam, New York.

Claim.—"The vibrating clearer and adjusting spring, in combination with the wing, divider, and operating wheel."

258. For an *Improvement in Journal Boxes for Railroad Cars, &c.;* James A. Norris, Philadelphia, Pennsylvania.

Claim.—"The combination of an ordinary gland and stuffing-box, with the journal box of a railroad car, whereby the oil is retained, and the admission of dust rendered impossible."

259. For an *Improvement in Grinding Mills;* Franklin Olds, Providence, R. I.

Claim.—"A grinding mill."

NOTE.—No idea of the nature of the above invention can be had except from the *whole* specification.

260. For an *Improvement in Rotary Pumps;* Oliver Palmer, Buffalo, New York.

Claim.—"The pistons, in combination with the metallic packing, said pistons and packing revolving together."

261. For an *Improved Door Spring;* Charles A. Peck, City of New York.

Claim.—"The employment of a variable bearing roller."

262. For an *Improvement in Machines for Binding Grain;* L. D. Phillips, Chicago, Illinois.

Claim.—"The circular revolving platform, in combination with the rake and apron, for the purpose of gathering the grain and conveying it to the binding receiver. Also, the peculiar construction and combination of the grooved arms with the slotted lever, for the purpose of carrying and crimping the band, and compressing the stalks in proper shape for binding. Also, the construction and arrangement of the apron with straps and pins, in combination with the box, for the purpose of feeding the binding clamps with bands taken from the mass of straw placed in said box, one at a time."

263. For an *Improvement in Rotary Steam Engines;* John B. Root, Youngstown, New York.

Claim.—"The arrangement of means for operating the oscillating abutment, and the valve."

264. For an *Improvement in Railroad Car Coupling;* John F. Rague, Dubuque, Io.

Claim.—"The rotating or revolving hook, in combination with the buffers, the above parts being placed within the draw-head."

265. For an *Improved Machine for Making Volute Springs;* D. G. Rollin, City of New York.

Claim.—"The combination of a conical roller with a mandrel, so as to coil a volute spring. Also, the combination of two conical rollers moving in opposite directions with a double conical mandrel, so as to coil a double volute spring at one operation. Also, directing the coiling of the plate into a volute spring, so as to cause it to assume the desired conical form, by means of the volute upon the conical roller, which volute is turned in a direction the reverse of that in the spring to be formed."

266. For an *Improvement in Joints for Carriage Tops;* A. C. Shelton and B. Tuttle, Plymouth, Connecticut.

Claim.—"Providing the lower ends of the arms with circular plates and shoulders, said plates being so arranged as to constitute a barrel over which the shoulders may move, said shoulders giving support to the arms."

267. For an *Improvement in Cider Mills;* H. O Sheidley, Republic, Ohio.

Claim.—"The hollow stem in communication with the interior of the curb, in combination with the follower and curb. Also, the combination of the cap-piece, ratchet piece, ratchet with its cheeks, cam lever, and secondary levers."

268. For an *Improvement in Port-folios;* H. T. Sisson, Providence, Rhode Island.

Claim.—"The cords passing through the strips or plates, and attached at one end to

the slides, fitted or placed within the guides, or any equivalent device for tightening the same, and the opposite ends attached to needles which pass through perforations in one of the strips."

269. For an *Improvement in Cotton Presses;* Riley Smith, Towanda, Pennsylvania.

Claim.—"So combining a set of falling weights, or their equivalents, with a movable cotton or pressing box and its levers, as that when the united force of said weights is applied to said box, it shall start it up to and draw in its levers, and admit of a better application of the first moving power of the press. Also, the so applying of the ropes or chains that draw down and force up the pressing-box to the follower, as that the slack of one shall lead or be in advance of the winding up of the other. Also, the application of the roller with its eccentrics and pins, for the double purpose of a fastening to said door, and as a means of tightening up the bale ropes."

270. For an *Improvement in Harness Saddles;* Richard Swift, New Haven, Conn.

Claim.—"The method of adjusting the pad of the harness, by means of the male screws on the turrets working in the female screws of the arms of the yoke, so as to spread the pad by elevating the arms in the boxes, or contract it by depressing them."

271. For an *Improvement in Governor for Steam Engines;* H. N. Throop, Pultneyville, New York.

Claim.—"The combination of their arms, or their equivalents, and links constituting the expanding rim, and the springs to operate."

272. For an *Improvement in Head-rests;* Elisha Waters, Troy, New York.

Claim.—"The portable folding head-rest for car and other seats, when made adjustable in, on, or by a strap buckled, or otherwise fastened to the back of the rest."

273. For an *Improvement in Seed Planters;* L. T. Ward, Marathon, New York.

Claim.—"The combination of devices for operating the plunger to deposit the seed automatically, consisting of the marking cogs, the lever, pin, and spring."

274. For an *Improvement in Locomotive Engines for Producing Increased Adhesion to the Rails when required;* Franz Windhausen, Duderstadt, Hanover.

Claim.—"In combination with exhaust steam pipes of locomotive engines, I claim the apparatus for drawing from the smoke-box, and forcing upon the rails in front of the driving wheels, the products of combustion, when said apparatus is revolved to operate by the reaction due to the escape of steam from the cylinder. Also, the arrangement for regulating the supply of hot air, smoke, and other products of combustion upon the rails, by causing the draft either through the chimney or the pipes, or both the chimney and the pipes."

275. For an *Improvement in Harvesters;* W. A. Wood, Hoosick Falls, New York.

Claim.—"So filling up the space between the forks or hounds of the tongue with the caster block, to which the caster wheel and lever are attached, as that by the introduction of a rod that passes through them, they may be made rigid, and serve to support each other in turning the machine."

276. For an *Improvement in Harvesters;* Walter A. Wood, Hoosick Falls, New York.

Claim.—"So constructing the frame of a combined reaping and mowing machine, and combining it with a spring track clearer, as that all that part of the frame in rear of the cutter bar may be disjointed and removed by simply taking out the bolts, said track clearer remaining attached, for the purpose of adapting the machine to the cutting of tangled or lodged grass without obstruction, whilst the machine, with the driver upon it, remains perfectly balanced."

277. For an *Improvement in Pumps;* T. G. Wynkoop, Corning, New York.

Claim.—"The combination of seat, loose piece, and rubber packing."

278. For an *Improved Circular Sawing Machine;* E. H. De Witt, Assignor to self and Butler N. Strong, Xenia, Ohio.

Claim.—"The construction of sawing machines, having one of the circular saws arranged vertically, and the other circular saw arranged horizontally, both saws cutting simultaneously, and being carried in adjustable frames."

279. For an *Improvement in Rotary Pumps;* Wm. A. Young, Charlotte, N. C.

Claim.—"Placing the sliding valves or buckets within the rotating head tangentially with its shaft, or tangential with a circle concentric therewith, and with the head, the head being placed eccentrically within the box or case, which is provided with the induction and eduction passages. Further, the curved projections at the outer ends of the valves or buckets."

280. For a *Paint Compound;* John M. Merrymon, Logansport, Assignor to self and J. H. Jordan, Attica, Indiana.

Claim.—"The combination of quick lime and resin, for a paint material."

281. For an *Improvement in Covering the Heads of Nails;* Wm. H. Van Gieson, Assignor to self, S. M. Buckingham, and E. Brown, Waterbury, Connecticut.

Claim.—"The invention consists in covering the heads of nails with sheet metal blanks cut in star form, and swaged on."

282. For a *Steam Spring Bedstead;* Charles T. Young, North Chelmsford, Assignor to self and Henry Crowther, Lowell, Massachusetts.

Claim.—"The rods connected to the end rails, when these rails and the side rails are connected by a common coupling to the bed post."

283. For an *Improvement in Potato Diggers;* Alex. Anderson, Markham, Canada.

Claim.—"The opening shares, and the share or shovel, in combination with fingers and revolving toothed cylinder, for the purpose of digging and separating potatoes from the soil."

Additional Improvements.

1. For an *Improvement in Portable Chairs;* Zebulon Lyford, Lowell, Massachusetts; patented May 13, 1856; additional dated December 8, 1857.

Claim.—"The jointed braces and the strap, so constructed and operated on the chair or other article, that by opening it the legs will be swung outward, and firmly held by the straightening, and holding, and setting the joints. Also, the peculiar arrangement and operation of the springs to start or commence folding the braces, or for unsetting the joints."

2. For an *Improvement in Winnowers;* Thomas J. Doyle, Staunton, Virginia; patented April 20, 1852; additional dated December 15, 1857.

Claim.—"The employment of an extended or elongated uppermost riddle diagram, formed and combined with double sloping top screen diagram; said screen being provided with the longitudinal central strip, or supporting ridge rail."

3. For an *Improvement in Skates;* Ferdinand Klein, Newark, New Jersey; patented April 1, 1856; additional dated December 22, 1857.

Claim.—"Casting in one piece the bar, heel plate, and loop, having a point which assists to support the bar. Also, forming the obtuse angles of the bar, to prevent the stock or wood of the skate from separating."

4. For an *Improvement in Self-adjusting Sack-holders;* Augustus Stoner, Mount Joy, Pennsylvania; patented April 28, 1857; additional dated December 29, 1857.

Claim.—"The cast iron clamp or clasp and its adjustments."

Re-Issues.

1. For an *Improvement in Grain and Grass Harvesters;* Wm. H. Seymour, Assignor to self and Dayton S. Morgan, Brockport, New York; patented December 14, 1852; ante-dated October 25, 1852; re-issued December 1, 1857.

Claim.—"The combination of the platform, the driving gear, the space between the platform and driving gear, for the discharge of gavel, the draft pole, and the stand or rest on the platform for the forker."

2. For an *Improvement in Grain and Grass Harvesters;* Wm. H. Seymour, Assignor to self and Dayton S. Morgan, Brockport, New York; patented December 14, 1852; ante-dated October 25, 1852; re-issued December 1, 1857.

Claim.—"The combination with the standard or rest upon the rear side of the platform,

for the person who rakes off the grain, and with the platform, of a strong rail firmly secured to the outer side of the main frame, and extending thence along the rear side of the platform to support it and the stand for the forker."

3. For an *Improvement in Grain and Grass Harvesters;* Wm. H. Seymour, Assignor to self and Dayton S. Morgan, Brockport, New York; patented December 14, 1852; ante-dated October 25, 1852; re-issued December 1, 1857.

Claim.—"The method of protecting the gearing from being injured by the working and twisting of the main frame, by mounting the said gearing in an auxiliary metallic frame, constructed and firmly attached to the main frame."

4. For an *Improvement in Cleaning Top-cards of Carding Machines;* Horace Woodman, Biddeford, Maine; patented August 1, 1854; re-issued December 8, 1857.

Claim.—"1st, The application and adaptation of the grooved cam, arranged with a sliding bar, as a means of producing the reciprocating motions by which the raising and depressing of a top card, or the reciprocating movements of the brush-bar in cleansing a top card, may be effected. 2d, The combining of the lifter cams and a brush-bar with one rotary shaft, so that by the movements of such shaft, the operation of raising and depressing a top card and cleansing it, may be effected."

5. For an *Improvement in Wheels for Carriages;* Thomas Brownfield, George's Township, Pennsylvania; patented August 19, 1856; re-issued December 15, 1857.

Claim.—"The rim of the hub, which is made in sections, which being constructed in this manner, will press on all the spokes and hold them all firm in the hub; and the iron plate which covers these sections, which will bend and let the sections fit the spokes with the pressure of the screws, and holds the sections to their places, and the nuts on the spokes which holds the felloes and the tire to their proper places."

6. For an *Improvement in Automatic Grain Weighing Machines;* Rufus Porter, Washington, D. C.; patented May 5, 1857; re-issued December 22, 1857.

Claim.—"1st, The combination of the tripping rods with the valve plates and knuckle braces, whereby the movement of the valve gate (which is operated by means of scale beams), causes the contents of the buckets to be discharged alternately. 2d, The knuckle braces, in combination with the trap door, whereby the latter are spontaneously closed and fastened immediately after the grain is discharged. 3d, The balance beams with horns, in combination with valve plate and catch levers, so arranged that the weight of grain in one bucket changes the position of the valve gate so as to turn a portion of the current of the grain into the other bucket, before the first bucket receives the quantity, the second horn trips the catch, and thereby turns the balance of the current of the grain into the other bucket."

Designs.

1. For *Cook Stove;* Elias Young, Assignor to Chamberlin & Co., Cincinnati, Ohio; dated December 1, 1857.

2. For *Cook's Stove;* Garettson Smith and Henry Brown, Philadelphia, Assignor to Wolfe, Moore & Co., Wrightsville, Pennsylvania; dated December 8, 1857.

3. For *Laundry Stoves;* A. C. Barstow, Providence, Rhode Island; dated December 15, 1857.

4. For *Stoves;* Benjamin W. Dunklee, Boston, Massachusetts; dated Dec. 15, 1857.

5. For *Trade Marks on Plough Springs, &c.;* James D. Willoughby, Pleasant Hall, Pennsylvania; dated December 15, 1857.

Claim.—"The design to be stamped, painted, moulded, or in any manner affixed on vulcanized india rubber, or its substitute, when used for the purpose of spring clevises for ploughs, or any other similar purpose."

6. For *Clock Fronts;* Elias Ingraham, Bristol, Connecticut; dated December 22, 1857.

7. For a *Cooking Stove;* Jacob Steffee, James Horton, and John Currie, Philadelphia, Assignors to M. W. Jackson and W. H. Wooden, Berwick, Pennsylvania; dated December 22, 1857.

The claims on the above, are for the several shapes, forms, ornaments, and configurations.

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Self-acting Regulator for Air-Pipes of Furnaces for Warming and Ventilating Buildings. By HENRY B. OSGOOD.

The ordinary means of supplying air to be warmed by furnaces is too well known in your city to need a description. The varying conditions of the atmosphere—warm and cold, calm and windy—render it impossible to govern the supply by the methods commonly adopted.

Some, to avoid the difficulties, have taken the air from damp cellars; others from an opening in the hall floor; but as a supply of 5 cubic feet of air per minute is requisite for healthful respiration, this latter method is fatal to health. The self-acting regulator invented by Mr. Samuel L. Hay and myself, is designed for preventing an excess of cold air from passing through the supply pipes in high and severe winds; and that chilling sensation arising from veins of cold air, or the body being fanned by swift currents. It also economizes fuel by preventing refluent currents. The tendency of the warmed air about the furnace to *pass out* and be lost, is more frequent than is generally supposed: this is produced by partial vacuums caused by the relation of the *mouth* of the pipe to the direction of the wind. It is very interesting to observe the operation of the regulator. It is an indicator of the amount of air supplied in calm weather: for it is easy to ascertain what pressure is requisite to overcome the weight or nut, *e*, and close the outer wing when it is adjusted to remain open and just resist the pressure of the current produced by the tendency to equilibrium, (the air being warmed about the furnace, and cold without,) then, knowing the area of the valve acted upon by the current, we can, by the following table, find the amount supplied in a given time.

Velocity of the wind. Miles in an hour.	Perpendicular force on one square foot, in avoirdupois lbs.	Common appellations of the force of such winds.
1	·005	Hardly perceptible.
4	·079	Gentle, pleasant wind.
5	·123	
10	·492	Brisk gale.
15	1·107	
30	4·429	High wind.
35	6·027	
50	12·300	A storm.
80	31·490	A hurricane.
100	49·200	

Of the following diagrams,

Fig. 1 is a vertical section through the regulator and supply pipe, showing the valve in its position when not affected by currents; the dotted lines representing its position when the inner wing, *b*, is closed by a refluent current, the weight, *e*, still hanging plumb. When the ten-

dency to vacuum about the mouth of the pipe ceases, the current turns inward and the inner wing instantly opens.

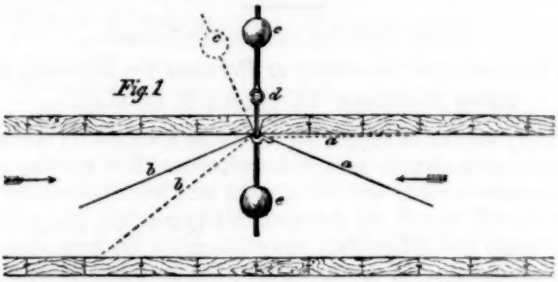


Fig. 2 is a similar section, showing the position when the outer or perforated wing, *a*, is closed by the force of the inward current, the weight, *e*, preventing it from closing too freely, and tending to throw it up when the pressure diminishes.

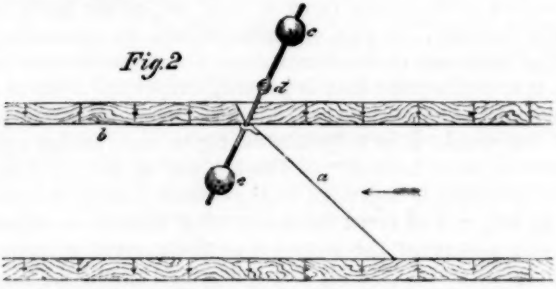
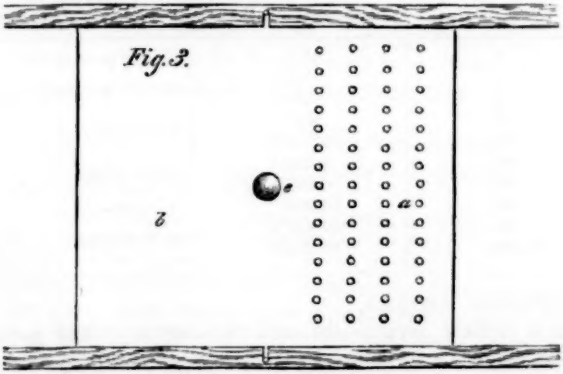


Fig. 3 is a plan with the cover of the supply pipe removed.

The equipoise, *c*, can be adjusted by the joint, *d*, so that either wing can be made to preponderate; or so that if the weight, *e*, is removed and all currents, the regulator will be balanced, and remain in any position it may be placed in its bearings.



The regulator may be used in smoke flues to prevent smoke and gases from blowing down, and produce a uniform current through the stove,

grate, or furnace. A small model I found useful to supply fresh air at the office; when the wind blew hard enough to depress the outer or perforated wing, it partially or wholly closed—thus limiting the supply, and preventing any unpleasant feeling, as would arise from an open window when the wind blew cold.

Northbridge, February, 1858.

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*Description of the Ventilating Fan at the Abercarn Collieries.**

The mode of ventilation that is still generally used in the collieries of this country, is the old furnace ventilation, where the required current of air through the mine is maintained by the rarefaction of the column of air in the ascending shaft, by means of a large fire kept constantly burning at the bottom of the shaft. In Belgium and France, on the contrary, this plan is almost superseded by the use of machinery to maintain the current of air; as the furnace ventilation, although possessing the important advantages of great simplicity, and freedom from liability to derangement from disturbing causes, has some serious objections and deficiencies; and in some cases becomes so imperfect a provision for ventilation, as to render a better system highly desirable, and even necessary.

The author of the present paper having occasion to ventilate the workings in some extensive and very fiery coal seams recently won at Abercarn, in South Wales, under circumstances where the furnace ventilation could not be applied, after carefully collecting every accessible information as to the ventilating machines used in Great Britain and on the Continent, came to the conclusion that a plan of machine proposed for the purpose, some years since, by Mr. James Nasmyth, would be the most suitable and effective. After consultation with Mr. Nasmyth, it was resolved to test the principle and plan by actual practice; and the ventilating fan described in the present paper was made at Patricroft, by Mr. Nasmyth, and is erected and now working at the Abercarn Collieries.

The fan is 13½ feet diameter, with 8 vanes, each 3 feet 6 inches wide and 3 feet long. It is fixed on a horizontal shaft, 8 feet 7 ins. in length from centre to centre of the bearings, which are 9 inches long, by 4½ inches diameter. The vanes are of thin plate iron, and carried by forked wrought iron arms, secured to a centre disk, carried by the shaft. The fan works within a casing, consisting of two fixed sides of thin wrought plate, entirely open round the circumference, and connected together by stay rods. The sides are 3 inches clear from the edges of the vanes, and have a circular opening, 6 feet diameter, in the centre of each, from which rectangular wrought iron trunks are carried down for the entrance of the air; the bearings for the fan-shaft being fixed in the outer sides of these trunks, which are strengthened for the purpose by vertical cast iron standards. The two air trunks join together below the fan, and com-

* From Newton's Lond. Journ., October, 1857.

municate with the pit by means of a horizontal tunnel which enters the pit at 21 feet depth from the top. The fan is driven by a small direct-acting non-condensing engine, fixed upon the face of one of the vertical cast iron standards, and connected to a crank on the end of the fan-shaft. The steam cylinder is 12 inches diameter and 12 inches stroke, and is worked by steam from the boilers of the winding engine of the pit, at a pressure of about 13 pounds per square inch. The eccentric for the slide valve is placed just inside the air trunk, and works the valve through a short weigh-shaft, with a lever on the outside.

The pit is of an oval form, 10 feet by 18 feet, and divided near the centre by a timber brattice,—the one side forming the upcast shaft, and the other the downcast. Both of these are used for winding, and the cages in which the trucks, &c., are brought up, work between guides fixed to the timbering of the pit. The pumps are placed in the downcast shaft. To allow of the upcast shaft being used for winding, the top is closed by an air valve, which is formed by simply boarding up the underside of the ordinary guard upon the mouth of the shaft, leaving only the hole in the centre, through which the chain works. This air valve is carried up by the cage on arriving at the top of the shaft, and then drops down again flat upon the opening when the cage is lowered. During the time that the valve is lifted, its place is occupied by the close bottom of the cage, which nearly fills the rectangular opening left at the top of the shaft. By this simple means the top of the upcast shaft is kept practically closed; for the leakage of air downwards through the top, whilst the cage is in the act of opening or closing the air valve, and through the small area that always remains open, is found to be quite immaterial, and the surplus ventilating power of the fan is amply sufficient to provide against it.

The total depth of the pit is nearly 300 yards, and at a depth of 120 yards a split of air is taken off, and coursed through workings from which coal and fire clay are got; the larger portion of the air descends to the bottom of the pit, and is there split into many courses, to work two separate seams of coal, and a vein of ironstone. The total length of road laid with plates or rails in the workings is about 7 miles, and the working faces amount to nearly double that distance. The longest distance that is traversed by any single course or split of air, in passing from the downcast to the upcast shaft, is nearly two miles. The quantity of materials raised from the pit is about 500 tons daily.

The speed at which the ventilating fan is usually worked is about 60 revolutions per minute, giving a velocity at the circumference of the fan of 2545 feet per minute; 45,000 cubic feet of air per minute are then drawn through the mine, nearly one-third of which ventilates the upper workings, and the rest passes through the lower workings.

A table appended to the paper gives the results of a series of experiments made with this ventilating fan, under the direction of the author, by Mr. R. S. Roper,—showing that the quantity of air delivered at the velocities of 60 and 80 revolutions of the fan per minute is 45,000 and 56,000 cubic feet per minute, with a velocity of current of 782 and 1037 lineal feet per minute respectively, or about 9 and 12 miles per hour;

and the degree of vacuum or exhaustion in the upcast shaft is ·5 and ·9 inch of water respectively.

In these experiments the mode adopted for ascertaining the velocity of the air currents, was by calculation from the difference of pressure, as observed by means of a carefully constructed vacuum gauge, the result being checked by the anemometer, and by the time of passage of the smoke of powder, fired at fixed distances, by means of wires from a voltaic battery at the top of the shaft. The working velocity of the fan is readily and instantly regulated by means of a throttle valve in the steam pipe of the engine, which is under the control of the man in charge of the working of the pit, and is adjusted according to the requirements of the ventilation arising from changes in the atmospheric pressure, and in the quantity of gas in the workings. It has been found that a velocity of about 50 to 60 revolutions per minute gives the best amount of ventilation, and that beyond 80 revolutions the current of air is too strong to allow of the lamps being kept alight in the workings.

This ventilating fan has been now in constant work for two years, night and day, without once stopping for repairs of any kind, and is in as good working order as when first started; there appears to be nothing to get out of order about the machine, on account of the simplicity of its construction, and no reason to anticipate any failure. The engine is made very simple in construction, with large and durable wearing surfaces, and the steam cylinder is fitted with a solid metal piston, to prevent any occasion for stopping to adjust the packing. The whole cost of the steam power for working the fan is so insignificant, that a little leakage of steam is quite immaterial.

The ventilating fan has a very important advantage over the furnace ventilation, in the power it affords of suddenly increasing the current of air to a great extent in any emergency; whilst, with the furnace, any increase is very slow in action and limited in extent, and cannot be effected from the surface of the ground.

Another advantage is the coolness and freshness of the upcast shaft, which can be used for the passage of the men as freely as the downcast shaft, being free from the heat and smoke of the furnace ventilation. There is also no risk of explosion from the access of gas to the furnace fire; and in the first opening of a fiery seam, as in the present case at Abercarn, a furnace could not have been safely lighted until after a long delay for drainage off the gas, owing to the sudden and extensive liberation of gas; and even then it would have been attended with considerable difficulty and danger; but with the help of the fan all delay and danger was avoided, and the workings commenced immediately on reaching the seam.

A bratticed shaft was the only plan practicable in the present case, on account of the great difficulty of sinking deep through the rock, which was of remarkable hardness; and in such cases the furnace ventilation is very objectionable on account of the constant leakage caused by the drying of the timber of the brattice from the effects of the heat of the fire, and the corroding action of the sulphurous vapors of the furnace smoke.

In the pit at Abercarn, the quantity of gas is so serious that safety-

lamps are now used exclusively throughout the workings, and not a single naked light is allowed, except at the two stations near the shaft, where the safety-lamps are lighted and locked up. Several very slight explosions have occurred, but not any at all serious in their consequences, except one, which may be mentioned as a useful example of the great practical value of the means of suddenly producing a greatly increased current of ventilation, in preventing loss of life from the result of explosion. In this instance, which occurred about October, 1855, one of the men took a naked candle into a stall in which fire damp had accumulated in the lower workings, at about 150 yards distance from the shaft. An explosion ensued, which was heard by the author, who was at the top of the shaft at the time, and he instantly turned the steam full on to the engine of the fan, which immediately increased the speed of the fan to nearly double its rate, and caused such a sudden increase in the velocity of the current of ventilation, that the after-damp resulting from the explosion was carried past the men in the workings so quickly that they escaped all serious injury, so momentary was their exposure to its effects. But if the ordinary velocity of current only had been maintained, some of these men could not have escaped with their lives. The man who caused the explosion was severely burnt, but recovered from the injury.

Almost immediately after turning on the steam to the fan, a shower of black particles was thrown out of the fan, which would be the result of the explosion, being the fine particles of carbon, liberated as light flaky soot from the decomposition of the carburetted hydrogen by the explosion. This is commonly but incorrectly called "coal dust," and is always the result of an explosion ; and, in the author's opinion, this is the cause of the fatal effect of the after-damp, from the accumulation of the minute solid particles upon the lungs, and not the exposure to the carbonic acid and nitrogen resulting from the combustion of the gas and air. This opinion is confirmed by the result of examination of the lungs of men killed by mine explosions, which are found to be loaded with these black solid particles. It has been observed frequently that men can live for some time in the after-damp following a mine explosion, if they take the precaution to cover their mouths and nostrils completely with a handkerchief, so as to sift the air they breathe and prevent these floating particles of carbon from entering the lungs ; and this precaution is enjoined in the rules of several mines, to prevent breathing the "coal dust," as it is termed.

A similar ventilating fan to that above described has been since erected, by Mr. Nasmyth, at Skiar Spring Colliery, near Elsecar, which is working with complete success; it is of rather larger size than the one at Abercarn, being 15 feet diameter, and 4 feet 3 inches wide in the vanes, and is worked at 80 revolutions per minute by the steam from a pumping engine boiler, at 15 lbs. per square inch. The result is a thoroughly efficient ventilation of the workings, completely under control at the surface of the ground, and maintained at an expenditure of fuel extremely small as compared with that required for the ordinary furnace ventilation.

*Conducting Power of Rocks—Altitude of Mountains not Invariable.**

By Charles Maclaren.

Mr. Hopkins of Cambridge has made some rather interesting experiments on the *conductivity* or conducting power of different substances for heat, of which an account was laid before the Royal Society of London, in June last. Without attempting to describe his processes, we give his more important results, and in decimals, the conductivity of "igneous rock" (trap or granite, we presume), saturated with moisture, being taken as unity.

Chalk, in the state of *dry powder*,	·056
Clay, " "	·070
Sand, " "	·150
Sand and clay, "	·110

The conductivity of the following rocks is given in two states—*dry*, and *saturated* with water:—

	Dry.	Saturated.
Chalk, in block,	·17	·30
Oolite rock,	·30	·40
Hard compact limestones,	·50	·55
Siliceous New Red sandstone,	·25	·60
Freestone,	·33	·45
Hard compact sandstones (Millstone Grit),	.51	.76
Hard compact old sedimentary,	·50	·61
Igneous rocks,	·53	1·00

The effect of *pressure* on the conducting power of substances was also tried, and proved to be almost nothing. A pressure of 7500 lbs. on a square inch of bees-wax, spermaceti, and chalk, had no appreciable effect. Uncompressed clay, which had a conducting power of ·26, had the same raised to ·33 by a pressure of 7500 lbs.

Sandstone, with conducting power of ·5, divided into strata each 1 foot thick, when compared with a similar mass in one block, had its conducting power diminished $\frac{1}{20}$th. When the strata were only 6 inches thick the diminution was $\frac{1}{10}$th. The effect of discontinuity of substance is therefore small. Saturation with moisture, on the other hand, produces generally a great effect, as will be seen on comparing the dry and saturated blocks of chalk, the dry and saturated new red sandstone, and again the dry and saturated "igneous rocks."

These facts have a certain bearing on a geological question—namely, the transmission of heat from the interior of the earth to the crust. The oolite, for instance, conducts heat much better than the chalk, the sandstone better than the oolite, the igneous rock better than the sandstone, and in all cases the rock charged with moisture better than the dry rock. But Mr. Hopkins would have added to the value of his paper if he had ascertained by experiment the quantity of water absorbed by each rock at given temperatures, and whether the conductivity is exactly in proportion to the absorption.

In illustration of the use that may be made of the tables, we would refer to certain remarks made by Dr. Robinson on a paper read by Professor Hennessey at the recent meeting of the British Association. The subject

* From the Edinburgh New Philosophical Journal, January, 1858.

was "The Direction of Gravity at the Earth's Surface." In alluding to certain supposed local and temporary changes of level, he mentioned the following curious fact:—"He found *the entire mass of rock and hill on which the Armagh Observatory is erected, to be slightly, but to an astronomer quite perceptibly, tilted or canted at one season to the east, at another to the west.* This he at first attributed to the varying power of the sun's radiation to heat and expand the rock throughout the year; but he subsequently had reason to attribute it rather to the infiltration of water to the parts where the clay-slate and limestone rocks met. The varying quantity of this (water) through the year he now believed exerted a powerful hydrostatic energy, by which the position of the rock is slightly varied." With the light furnished by Mr. Hopkins's experiments, we may pronounce the explanation satisfactory. Armagh and its observatory stand on a hill at the junction of the mountain limestone with the clay-slate, having, as it were, one leg on the former, and the other on the latter, and both rocks probably reach downwards one or two thousand feet. When rain falls, the one will absorb more water than the other; both will gain an increase of conductive power, but the one which has absorbed most water will have the greatest increase; and being thus the better conductor, will *draw a greater portion of heat from the hot nucleus below to the surface*—will become, in fact, temporarily hotter, and, as a consequence, *expand more than the other.* In a word, *both rocks will expand at the wet season; but the best conductor, or most absorbent rock, will expand most, and seem to tilt the hill to one side; at the dry season it will subside most, and the hill will seem to be tilted in the opposite direction.*

The fact is curious, and not less so are the results deducible from it. *First*, hills are higher at one season than another, a fact we might have supposed, but never could have ascertained by measurement. *Second*, they are highest, not as we would have supposed at the hottest season, but at the wettest. *Third*, it is from the *different rates* of expansion of different rocks that this has been discovered; had the limestone and clay-slate expanded equably, or had Armagh Observatory stood on a hill of homogeneons rock, it would have remained unknown. *Fourth*, though the phenomenon is in the strictest sense *terrestrial*, it is by converse with the *heavens* that it has been made known to us. A variation of probably a second, or less, in the right ascension of three or four stars, observed at different seasons, no doubt revealed the fact to the sagacious astronomer of Armagh, and even enabled him to divine its cause; which has been confirmed as the true cause, and placed in a clearer light by the experiments of Mr. Hopkins. One useful lesson may be learned from the discovery—to be careful to erect Observatories on a homogeneous foundation.

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*Construction and use of the Turkish Bath.**

As there has been much talk lately about Turkish baths, and whether it is possible or desirable to bring them into common use in this country, and as we know that there are most erroneous notions prevalent

* From the London Builder, No. 768.

with respect to their cost and comfort, a short account of a visit to one recently constructed at South Preston Cottage, North Shields, may possess some public interest.

The residence is one very common among the middle class in this country,—a small dwelling-house, surrounded by a garden, and having a vinery attached to the house. Behind this vinery is a small oblong apartment, 8 feet high, about 16 feet long, by 6 feet wide. At one end of this a furnace is constructed outside, and a flue, 10 inches by 12 (in height and breadth), carried beneath the floor, composed of flat red tiles: a brick partition was thrown across, including a small wooden door: the walls are furnished with ventilators, and a small aperture is in the chimney to carry off the over-heated air. Thus, at a cost of from £10 to £20, and with two or three hours' firing, the fuel costing about 4*d.*, you are able to obtain and maintain, for twelve hours, a heat in the inner apartment varying from 120 to 150 degrees, and in the outer from 80 to 90 degrees, two hours being the usual time to complete the processes. On a fine, clear, rather frosty night, just as the moon was rising above the trees, robed in the bath-dress, a loose flowing cape reaching to the knees, we were conducted by our host from the vinery (with its sashes open) into the outer bath apartment, where, seated upon low stools, with the thermometer at 85 degrees, we were soon in a most genial glow. Thus prepared, we entered the inner apartment (leaving the loose gown —wearing small aprons), the atmosphere at 125 degrees. Seating ourselves, *à la* Turk, on a low wooden bench, we waited in profound silence the moment when all our skin impurities should "melt, thaw, and resolve themselves into a dew." Nor had we long to wait. Soon a most copious shower of perspiration ran from every pore. Our attendant commenced a brisk friction with hands and feet over the whole surface of body, and produced a result that we confess we were not prepared for. Accustomed to daily use of the ordinary warm and cold baths, and the constant use of "flesh gloves," we fancied that we had left little to be removed; but under the skilful hands of our manipulator, we were soon divested of a rough coat of dead epidermis, that must have been a terrible obstacle to the delicate process of respiration, which nature intends to go on constantly over the whole surface of the body. Next we were rubbed from head to foot with soap, followed by a delicate stream of warm water poured over us, which produced a delightful glow of invigoration such as we have rarely experienced before. A sense of purity over the whole body, and a deep calm as of settled peace fell upon us with all the freshness of a new birth. Next a bracing stream of cold water, and we stepped again into the first apartment. When the body had been rubbed perfectly dry, we were conducted into the vinery, where, reclining on a couch, every muscle in repose, we were exposed to a current of cold air, with the loins only girded. The night, we have said, was frosty; such a night as your comfortable and well-clad Englishman shudders at the idea of exposure to.

Yet, as we imbibed a fragrant cup of coffee, and watched the soft light of the moon through the overhanging vines, there was no feeling of chill, but one of perfect health and renewed energy vibrated through

the body; while, through the mind, sympathizing as ever with her earthly dwelling, passed rapid visions of all that was pleasant in the past or hopeful in the future; and we left the dwelling of our friend convinced that few of the blessings of modern civilization, as auxiliaries to health and comfort, are to be compared to this English version of the Turkish bath, and glad that there are few martyrs to rheumatism and disease of the overtaxed respiratory organs among our countrymen who may not, at a trifling cost, possess themselves of this which would really seem to be a blessing.

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*On the Electrical Light.** By H. W. Dove.

The experiments, in connexion with the results of the prismatic investigation of the spark, appear to me to lead to the following conclusion:—

A wire becoming red-hot by heat is first red, then orange, and lastly white, so that it behaves like the combination of light which is obtained when a screen is drawn away from the spectrum concealed by it, in such a way that the red end first becomes visible, and to this the violet is finally added. The increase of brilliancy, from the slightly luminous brush to the bright spark, behaves quite otherwise. In this case it is as if the screen removed first set free the violet end, and then the other colors. This distinction of itself renders it improbable that the phenomena of electrical light, in the state of less brilliancy, can be ascribed to a gradually increasing ignition of solid particles. They rather resemble the weakly luminous flame of hydrogen, which becomes white by solid ignited carbon in the so-called gas-flames, or by other solid matters, as in the Drummond light. The true electrical light is produced at great distances in the surrounding, isolating, aëriform medium, when the latter is attenuated. With this colored light belonging to the strongly refrangible part of the spectrum, phenomena of ignition may be combined, by particles torn away from the positive and negative bodies. If these particles be only at a red heat, the impression of a violet light is produced by their mixture with the electric light. To this class belong the column of light in the electrical egg, and the basal point of the brush, and, lastly, the indented reddish sparks of an electrical machine, at distances to which a white spark does not pass. If particles at a white heat come together, the whole is white, as in the sparks of Leyden jars; in opposition to the bright light of incandescence, the less strongly luminous electric light disappears in the same way as the weak bluish lower part in a gas-flame appears black in opposition to the bright mass of light, whilst with the small brilliancy of a wax-light the latter betrays its color even without optical aids of absorption. Only prismatic analysis and the action upon uranium glass indicate the presence of the electric light also. If the particles at a white heat do not reach each other, the spark acquires a spot of interruption, which, however, still shows red light besides the true electric light, when the particles previously at a white

* From the Lond., Edin., and Dub. Philos. Mag., Nov., 1857.

heat have become cooled to redness. The basal point of the brush, which retrogrades in proportion to the larger field in which the electric light becomes visible, is to be compared with the spot of interruption of the spark; the particles of the solid body which are here still red-hot may, on reaching a greater distance, be completely extinguished, so that then the electric light alone prevails. The brush could not be colored by a spirit-flame colored yellow with chloride of sodium held under it, as it then becomes converted into a spark. The phenomena of the exhausted tube with mercury, indicate the modification which the electric light undergoes in media other than atmospheric air.

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*On Lighting Mines by Gas.**

The first meeting of the session 1857, 1858, of the Institution of Civil Engineers, on Nov. 10, Robert Stephenson, Esq., M. P., President, in the chair, was occupied by receiving a paper On Lighting Mines by Gas, by Mr. Alexander Wright, Assoc. Inst. C. E. The author remarked that the present mode of employing tallow candles or oil lamps, was prejudical to the health of the miners, whilst the light afforded was inadequate. The expenditure of oil and tallow in the mines of England might be roughly estimated at £500,000 per annum. In Cornwall and Devon alone there were about 30,000 men employed underground, who were lighted at an annual expense of £90,000 per annum; and in one of the large mines the annual expenditure for candles had reached as high as £7000. An attempt had formerly been made at the Tresevean mine, in Gwennap, to introduce gas, but it was abandoned. The author thought it was preferable to make the trial upon a mine where explosive gases were not given off, as in coal mines, and where the work was closer and did not extend so rapidly.

The first object was to light the ladders, and afterwards to extend the system to the working chambers following the lode. The mine selected for experiment was the Balleswidden mine. The gas introduced to this mine was manufactured at the surface, and was forced by a pump into a heavy gas holder, composed of cast iron plates, whence it issued by a descending pipe into the mine, under a pressure equal to 18·7 inches of water. The shaft and levels were fitted with wrought iron tubes, proved by high pressure steam, and from the branches flexible tubes and burners were carried into the pitches and chambers for the miners, and to the floors for picking the ore. The tramways also had a sufficient number of burners, to preclude the necessity for using any candles or lamps in the mine.

The comparative expense of the two systems of lighting was stated to be much in favor of gas, as the annual cost of candles was £834 3*s.* 4*d.*, whereas that of gas was £487 2*s.*, including interest on plant, wear and tear, and all expenses. If several mines combined, the economy would be still greater; and when the system became more general, modifications would doubtless be advantageously introduced. It was stated that

*From the Lond Mech. Mag., November, 1857.

the sanitary condition of the mine was visibly improved ; the ventilation was better, and there was an entire absence of the sickening smoke and bad odor previously pervading the mine, which the author believed to arise from some particular compounds of hydrogen and carbon given off during the imperfect combustion of the candles. The experiment was stated to have been completely successful, and there did not appear to be any reason why the system should not be extended to mines generally, and, under certain precautionary measures, to coal mines.

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*Artesian Wells in the Sahara Desert.**

The *Moniteur Algérien* brings an interesting report on the newly-bored Artesian wells in the Sahara Desert, in the province of Constantine. The first well was bored in the Oasis of Oued-Rir, near Tamerna, by a detachment of the Foreign Legion, conducted by the engineer M. Jus. The works were begun in May, 1856, and, on the 19th of June, a quantity of water of 4010 litres per minute, and of a temperature of 21° Réaumur, 79·25° Fah., rushed forth from the bowels of the earth. The joy of the natives was unbounded ; the news of the event spread towards the South with unexampled rapidity. People came from long distances, in order to see the miracle ; the Marabouts, with great solemnity, consecrated the newly-created well, and gave it the name of "the well of peace." The second well, in Temakin, yielded 35 litres, of 21° temperature, per minute, and from a depth of 85 metres; this well was called "the well of bliss." A third experiment, not far from the scene of the second, in the Oasis of Tamelhat, was crowned with the result of 120 litres of water per minute. The Marabouts, after having thanked the soldiers in the presence of the whole population, gave them a banquet, and escorted them in solemn procession to the frontier of the Oasis. In another Oasis, that of Sidi-Nached, which had been completely ruined by the drought, the digging of "the well of gratitude" was accompanied by touching scenes. As soon as the rejoicing outcries of the soldiers had announced the rushing forth of the water, the natives drew near in crowds, plunged themselves into the blessed waves, and the mothers bathed their children therein. The old Emir could not master his feelings ; with tears in his eyes, he fell down upon his knees, and lifted his trembling hands, in order to thank God and the French. This well yields not less than 4300 litres per minute, from a depth of 54 metres. A fifth well has been dug at Oum Thiour, yielding 108 litres per minute. Here a part of the tribes of the neighborhood commenced at once the establishment of a village, planting at the same time hundreds of date-palms, and thus giving up their former nomadic life. The last well is that of Shegga, where soon an important agricultural centre will spring up. There is no doubt but that these wells will work in these parts a great social revolution. The tribes which, after the primeval custom of their ancestors, kept wandering from one place to another, will gather round

* From the London Athenæum, October, 1857.

these fertilizing springs, will exchange the herdsman's staff for the plough of the farmer, and thus take the first steps towards a civilization, which, no doubt, will make rapid progress in Northern Africa.

For the Journal of the Franklin Institute.

Particulars of the Steamer General Concha, No. 2.

Hull built by Laurena & Foulks. Machinery by Birkbecks & Hodges, New York. Intended service, Harbor of Havana and Coast of Cuba.

HULL.—

Length on deck from fore part of stem to after part of stern post, above spar deck,		110 feet.
Breadth of beam at midship section (molded),		27 "
Depth of hold to spar deck,		9 "
Draft of water at load line,		7 "
" " at below pressure and revolutions,		7 "
Area of immersed midship section at this draft,		160 sq. ft.
Tonnage,	220.	
Masts and rig—	Foresail and jib.	

ENGINES.—Inclined direct.

Diameter of cylinders,		28 inches.
Length of stroke,		4 feet.
Maximum pressure of steam in pounds,	25.	
Cut-off—three-fourths stroke.		
Maximum revolutions per minute,	22.	

BOILER.—One—Return flued.

Length of boiler,		20 feet.	
Breadth "		7 "	
Height " exclusive of steam chimney,		7 "	4 inches.
Number of furnaces,	2.		
Breadth "		3 "	
Length of grate bars,		6 "	
Number of flues,	above 5—below 10.		
Internal diameter of flues, above,		1 "	1 "
" " below,	2	1 "	
	8		8 "
Length of flues, above,		15 "	
" below,		11 "	6 "
Heating surface (fire and flues),		740 sq. ft.	
Diameter of smoke pipe,		2 feet	9 inches.
Height "		18 "	
Description of coal,	Bituminous or Anthracite.		
Draft,	Blower.		

PADDLE WHEELS.—

Diameter,	19 feet	6 inches.
Length of blades,	4 "	3 "
Depth "		22 "
Number "	16.	

Remarks.—Floor timbers at throats—*molded* 11 inches; *sided* 6 ins. Distance of frames apart *at centres*, 22 inches. This vessel is built for account of H. C. M. Government, and is designed for towing. Her engines are not connected one with the other. C. H. H.

The Great Blast at Holyhead.

In presence of upwards of 1000 persons, a portion of the Holyhead mountain, which is 122 feet in height, was displaced, on the 21st inst., by a blasting operation of unparalleled magnitude. The removal of a considerable portion of the mountain is necessary for the formation of the new harbor of refuge, which is now being constructed under the superintendence of Messrs. J. and C. Rigby, who personally superintended the operations, assisted by Mr. G. C. Reitheimer, the resident engineer of the firm. Two or three of these operations have already taken place, and so eminently successful were they, as to induce the engineers to attempt another on a much larger scale. The arrangements contemplated the displacement of 120,000 tons of rock, by the application of 18,000 lbs. of gunpowder. At the last moment, the engineers determined still further to extend the operation, and for this purpose two additional chambers of mines were prepared, making the weight of gunpowder used 21,500 lbs., and the body of rock displaced no less than 160,000 to 200,000 tons, being far more than could have been calculated on. At a given signal, all the chambers were simultaneously ignited, and the huge body of the rock and mountain was upheaved, and fell down on the side in large fragments of several tons each. It will be removed by railway, for the purpose of completing the breakwater, from which it is about two miles distant.—*London Builder*, No. 747.

Steam Hammers.

These tools have gone on increasing in quick gradations, until the climax of a 6½ tons, dead hammering weight, with a fall of 7 feet 6 inches, has been reached. A hammer of this weight has been lately erected, and is now in operation at the works of Mr. A. Fulton, of Glasgow.—*London Builder*, No. 769.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, February 18, 1858.

John C. Cresson, President, in the chair.
John Agnew, Vice-President, } Present.
Isaac B. Garrigues, Recording Secretary, }
The minutes of the last meeting were read and approved.

Letters were read from the Royal Society of London, and the Royal Geographical Society of London.

Donations to the Library were received from the Royal Geographical Society, London; William A. Burt, Detroit, Michigan; Hon. D. Dale Owen, Jeffersonville, Indiana; Prof. A. D. Bache, U. S. Coast Survey, Washington City, D. C.; the Maryland Institute, Baltimore, Maryland; the Trustees of the Philadelphia Gas Works, and Dr. Thomas S. Kirkbride, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer read his statement for January, 1858.

The Board of Managers and Standing Committees reported their minutes.

New Candidates for membership in the Institute (2) were proposed, and the candidates (3) proposed at the last meeting were duly elected.

The Standing Committees for the ensuing year were appointed by the President, and approved, as follows:

On the Library.

John Allen,
James H. Cresson,
George W. Conarroe,
George Erety,
Samuel B. Finch,
Raper Hoskins,
James T. Lukins,
H. K. Plumly,
John H. Quail,
Thomas S. Stewart.

On Cabinet of Models.

William B. Bement,
William H. Clark,
Richard H. Downing,
George C. Howard,
Henry Howson,
Samuel W. Leinau,
Samuel Price,
Samuel J. Reeves,
Chas. E. Smith,
Chas. J. Shain.

On Cabinet of Minerals.

Isaac H. Conrad,
John F. Frazer,
F. A. Genth,
B. Barton Gumpert,
John L. Le Conte,
J. P. Lesley,
B. Howard Rand,
Robert E. Rogers,
Laurence Turnbull,
John C. Trautwine.

On Cab. of Arts & Manuf.

James C. Booth,
Thomas Bickerton,
Samuel Broadbent,
Edward P. Eastwick,
David M. Hogan,
Edward Mason,
John L. Perkins,
F. de B. Richards,
John R. Rowand,
John Wallace.

On Exhibitions.

John E. Addicks,
John Agnew,
James H. Bryson,
James H. Cresson,
Owen Evans,
John M. Gries,
Joseph Harrison, Jr.,
Thomas S. Stewart,
Isaac S. Williams,
Thos. J. Weygandt.

On Meetings.

Wm. B. Atkinson,
Jas. H. Billington,
James Dougherty,
William Erety,
Henry Howson,
Washington Jones,
Alfred L. Kennedy,
Angus N. Macpherson,
B. Howard Rand,
Joseph K. Wheeler.

On Meteorology.

Chas. M. Cresson,
Owen Evans,
John F. Frazer,
James A. Kirkpatrick,
Samuel S. Garrigues,
E. Otis Kendell,
Alfred L. Kennedy,
James A. Meigs,
Fairman Rogers,
Ayres Stockly.

Washington Jones exhibited the following:

J. P. Wendell's Improved Axle Box for Carriages and Railroad Cars. The improvement consists in a collar forming part of the axle, which works in a recess about the middle of the length of the box, composing an oil chamber. The inner end of the box consists of a brass tube bored to fit the axle, and screwed on the outside, which is somewhat greater in diameter than the collar; this tube is cut axially in two pieces, so that it can be put into its place between the collar and the shoulder of the axle where it fits with some end play. The box itself has its inside diameters to suit those of the axle and the collar, and its inner end screwed for the reception of the brass tube. When put together, the box, as

a whole, has a diameter rather greater than the axle, with a recess or chamber for the collar. This chamber holds the oil which is carried to the top of the box by its rotation, whence it flows and lubricates the axle. The car box and axle are similar in principle, but differ in arrangement; the box being in two pieces, the lower one with a shell or flanch extending upwards to receive the top one, and the collar and recess are as in the carriage box.

A Safety Cap, designed by J. T. Williams, to prevent explosions of fluid lamps while being filled when lighted, formed of wire gauze and screwed fast to the tubes of the lamp, protecting the fluid or its vapor from contact with the flame, as in Davy's safety lamp.

A piece of wire drawn from oreide which had become heated to redness in a fire of anthracite, and then cooled off, when it presented the appearance of copper, the other more fusible ingredients (see *Journal Franklin Inst.*, vol. xxxv, p. 63,) being burned or melted out.

T. Shaw's Self-Regulating Wind-Mill, with a vertical shaft, and two setts of radiating arms, to which the vanes or sails are hung by means of gudgeons at the top and bottom of their outer edges, about which they swing freely; the inner edge is secured to the extremity of the adjacent arm by an elastic cord, which permits it to move angularly in one direction without restraint, and in the other, until arrested by tension. The design is to have the cord of such an elasticity that the vanes upon the impelled arms shall present the most favorable angle with the current of wind to receive its impact; thus, one would be at right angles, or nearly so, to the advancing current, when its supporting arms were at right angles; while those before it form acute angles, and those behind it obtuse angles, all being in a condition to cause rotary motion to the shaft. The vanes upon the returning side of the wheel, not being restrained by the cords, swing upon their gudgeons by the action of the wind as the wheel turns, and present their edges only to the current. This wheel is ready for action, no matter what the direction of the wind, and would suit agricultural purposes.

Also, Mr. J. H. Lanning's Life-Boat, formed of cork, or other buoyant material, stiffened by pine boards. It is scow-shaped and formed of nine pieces, the bottom and sides of the body being in three, and the bow and stern three each. These pieces are attached together by metal hinges, and the joinings are made water-tight by a covering strip of vulcanized gum attached to the adjacent pieces. The improvement is, in the ability to fold the boat so as to occupy as little space as possible when on shipboard. When opened it is kept so by the thwarts, which fit into niches cut in the sides of the boat. Mr. Lanning proposes to make the boat self-righting by means of a weight and cord attached to the under side or keel, which, when the boat capsizes, winds partly around it, and unwinds by the force of gravity when the upsetting influence ceases.

Mr. Return Sheble exhibited an improved polariscope for the lecture table. It consists of a bundle of glass plates for an analyzer, revolving on a perforated disk, and a painted glass plate for a polarizer; the instrument can be reversed so as to analyze by refraction and reflection.

Abstract of Meteorological Observations for December, 1857; made in Philadelphia, Northampton, Somerset, and Huntingdon Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

December, 1857.	PHILADELPHIA.—Lat. 39° 57′ 28″ N. Long. 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. KIRKPATRICK, Observer.									EASTON, Northampton Co.—Lat. 40° 43′ N. Lon. 75° 16 W. Height above the sea about 340 feet. SELDEN J. COFFIN, Observer.						SOMERSET, Somerset Co.—Lat. 40° N., Lon. 79° 3′ W. Height about 2180 ft. GEO. MOWRY, Observer.				HUNTINGDON, Huntingdon County. JACOB MILLER, Obsr.		
	Barometer.		Thermometer.			Relative humidity.	Force of vapor.	Rain and Snow.	Prevail'g winds.	Bar.	Ther.	Relative humidity.	Force of vapor.	Rain and Snow.	Prevail'g winds.	Bar.	Ther.	Rain and Snow.	Prevail'g winds.	Ther.	Rain and Snow.	Prevail'g winds.
	Mean.	Mean daily range.	Mean.	Daily oscillation	Mean daily range.	2 P. M.	2 P.M.			Mean.	Mean.	2 P.M.	2 P.M.			Mean.	Mean.			Mean.		
	Inch.	Inch.	°	°	°	Per.ct.	Inch	Inches.		Inch.	°	p. c.	Inch.	Inch.		Inch.	°	Inches.		°	Inch.	
1	29·953	·169	50·3	19	6·2	46	·216	0·288	WNW	29·613	40·8	52	·179	0·53	N W.	27·779	33·7		W.	31·0		W.
2	29·954	·072	41·7	16	8·7	56	·188		W.	29·613	36·7	52	·145		W.	27·715	33·3		W.	37·5		N W.
3	29·917	·087	43·3	16	1·7	38	·139		WSW.	29·577	37·3	36	·100		W.	27·790	32·7		W.	37·0		N.
4	29·996	·079	40·7	12	2·7	38	·115	0·240	(var.)	29·663	33·7	26	·062		W.	27·764	32·3	0·357	W.	34·5		W.
5	29·896	·100	37·7	8	3·0	78	·100	(var.)		29·593	30·8	84	·169	0·10	N E.	27·632	37·3		W.	35·0		S.
6	29·715	·191	42·7	14	5·9	96	·256	1·522	E.	29·427	36·7	95	·228	0·88	(var.)	27·4·9	35 7	0·368	S.	35·0	0·035	W.
7	29·902	·261	49·0	14	9·0	35	·166		W	29·560	41 0	28	·107		N W.	27·711	40·3		S W.	39·0	0·456	S W.
8	29·887	·126	52·7	18	3·7	70	·336		S W.	29·560	46·5	60	·246		S E.	27·663	51·7		W.	47·0		S W.
9	29·671	·216	56·0	15	5·3	90	·391	0·202	N E.	29·370	43·0	89	·255	1·27	E.	27·447	55·7	0·422	S W.	44·0	0·505	S W.
10	29·694	·211	47·0	19	9·0	38	·139	0·413	N W.						W.	27 608	31·0		W.	34·5	0·399	W.
11	30·111	·417	35·5	11	11·5	55	·130		W.	29 767	30·7	53	·108		N W.	27·833	24·3		W.	27·0		W.
12	30·392	·281	31 2	17	4 3	56	·122		(var.)	30·080	23·3	47	·082		W.	27·978	21·0		S S E.	23·0		N.
13	30·301	·097	33 7	16½	2 5	49	·125		W.	29·950	25·8	63	·132		(var.)	27·916	29·3		S W.	27·5		N.
14	30·065	·236	41·8	22	8·2	44	·176		S W.	29·707	38·3	42	·151		(var.)	27·898	37 3		WSW.	39·0		W.
15	30·093	·060	44 7	13	3·8	52	·196		(var.)	29·810	36·8	62	·192		(var.)	27·897	38·3			37·0		W.
16	30·151	·083	42·3	14	2·3	64	·223		N E.	29·827	38·7	78	·210		W.	27·882	36·0		W.	38·0		W.
17	29·968	·182	45·3	11	3·7	77	·260	0·548	N. E.	29·650	41·3	80	·229		(var.)	27·641	36·3	1·028	(var.)	41·0	1·003	S W.
18	29·600	·369	54·5	14	9·2	64	·308		S W.	29·177	51·0	61	·256	0·76	W.	27·404	42·7		W.	43·5		W.
19	29 989	·390	44·7	11	9·8	51	·180		N W.	29·657	35·7	49	·126		(var.)	27·819	32·0		WNW	35·0		N W.
20	30·222	·233	36·8	13	7·8	49	·129		N W.	29·897	29 2	50	·109		(var.)	27·960	28·7		W.	28.5		N.
21	30·113	·165	37·0	14	2 5	65	·168	0·756	N E.	29·793	29·0	73	·144		S E.	27·773	31·3	0·578	S.	34.0	0·465	S.
22	29·500	·613	45·7	14	8·7	60	·232		W.	29·087	39·7	80	·240	0·40	(var.)	27·344	33·0	0·048	W.	32 0	0 016	N W.
23	29·577	·076	40·2	11	5·5	27	·079		S W.	29·163	34·0	33	·074		W.	27·354	28·7		WSW.	37·5		W.
24	29·794	·217	41·5	14	2·0	38	·126		W.	29·437		45	·121		W.	27·618	32·0		W.	33·5		W.
25	29·770	·165	28·7	9	12·8	61	·100		N E.						E.	27 498	29·3		(var.)	29·5		S E.
26	29·702	·108	25 7	4	3·0	82	·117	0·168	(var.)	29·353	17·2	91	·101	0·19	(var.)	27 404	27 3		W.	30·5		N W.
27	30·087	·385	27·0	17	4·0	69	·125	0·013	S W.	29·733	18·0	87	·123	0·01	(var.)	27·768	25·7		(var.)	29·5		(var.)
28	29·915	·172	37·2	15	10·2	77	·188	0·248	S W.	29·560	32·0	60	·134		(var.)	27·634	36·0	0·507	S W.	35·0	0 126	S.
29	29·817	·098	37·0	5	2·2	95	·214		E.	29·487	32·5	94	·181	1·11	N E.	27·514	37·3	0·216	W.	37·0	0·236	S.
30	29·690	·127	38·2	7	2·5	91	·212	1·165	N E.	29·352	33·0	89	·168		(var.)	27·366	37·7	0·703	S.	36·0	0·711	E.
31	29·428	·354	42·3	13	6·2	47	·163		WSW.	29·007	36·5	50	·134	0·01	W.	27·183	30·3	0·050	W.	31·0	0 067	W.
Means	29·899	·205	41·0	13½	5·7	60	·184	5·503	s58°w.	29·561	34·6	62	·155	5·26		27·652	34·0	4·277			4·019	